PUBLIC LIBRARY

Standard Size, 9 x 12. AUGUST 13, 1896. Price, Six Cents.

AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

ISSUED WEEKLY BY THE AMERICAN MACHINIST PUB. CO.,
256 BROADWAY, NEW YORK.

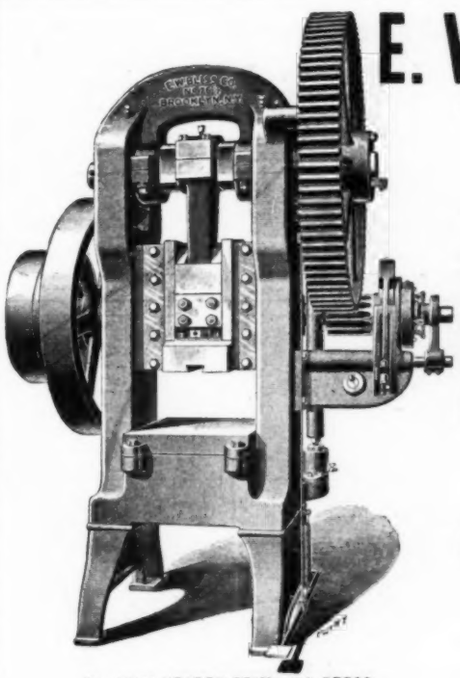
VOL. 19. No. 33.

CONTENTS.

PAGE

Finishing Large Connecting Rods—De La Vergne Shops. By John Randol 755
The Everlasting Mandrel Question—Expanding Boring Tools. By C. O. Griffin 758
Tensile Strength of Screw Threads.. 759
Trial of Compressed-Air Car Motors. 759
A Manufacturing Machine Shop. III. 759
A Shaper as a Milling Machine—A Job of Internal Milling—An Interesting Molding Machine. By S. T. Freeland 764
Electrical Machinery: Controlling Devices for Series-Wound, Constant Potential, Electric Motors. By Wm. Baxter, Jr....Special Patterns of Walker's Magnetic Chucks.... Electrically-Driven I-Beam Cold Saw and Automatic Saw-Sharpening Machine.....766-769
Letters from Practical Men: Testing Indicator Springs. By I. Walton ...Quarter Twist Belts with Idlers. By Chas. H. Moyer...."How to Mold It." By L. C. Jewitt....High Speed in Drilling. By Superintendent....Arbor Practice — Oiling Drills. By John F. McNutt.... Inventor of the Pelton Water Wheel. By John E. Sweet....The Landis Method for Deep Drilling. By G. S. Boesch.....769-771
Quality of Goods for Export..... 772
"Theory and Practice"..... 772
Japan as an Industrial Factor..... 772
Questions and Answers..... 773
Bids on and Award of Contracts for Army Gun Carriages, Gun Forgings, Mortars and Rapid-Fire Guns, 773
A New Bevel-Gear Cutting Machine. 774
Commercial Review..... 775

Index to Articles Advertised, Pages 10 to 13.
Index to Advertisers, Page 9.



No. 76½ GEARED TRIMMING PERSS.

E. W. BLISS CO.
2 Adams St., BROOKLYN, N.Y.
CHICAGO: 96 W. Washington St.

OWNING AND OPERATING
The Stiles & Parker Press Co.
PRESSES
Dies, Shears, Drop Hammers and Special Machinery
FOR ALL
Sheet Metal Work.

400-PAGE CATALOGUE,
ALSO SPECIAL CATALOGUES OF BICYCLE AND ELECTRICAL TOOLS.

CORRESPONDENCE SOLICITED.

GRAPHITE.

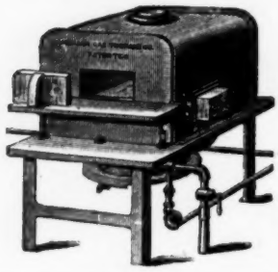
There are as many kinds and qualities of graphite (commonly known as blacklead or plumbago) as there are kinds and qualities of metals and tools—probably more—but for lubricating purposes and for reducing friction of all kinds to the minimum, there is one graphite only hat has given universal satisfaction, and that is

DIXON'S pure flake GRAPHITE

It has never failed to please all locomotive and stationary engineers and all machinists and master mechanics who have tested its wonderful qualities. There s nothi g that can match it, and nothing to equal it. It is as necessary to the engineer as an oil can, hammer or wrench.

We will send without charge sample and pamphlet to any one interested. Mention AMERICAN MACHINIST.

JOSEPH DIXON CRUCIBLE CO.
JERSEY CITY, N. J



AMERICAN GAS FURNACE CO.,

Oil Gas Plants

GAS BLAST FURNACES AND HIGH PRESSURE BLOWERS

For the economical generation and systematic application of HEAT

CATALOGUES ON APPLICATION.

No. 80 Nassau St., NEW YORK.

English Agency: {Chas. Churchill & Co., Ltd., 21 Cross St., Finsbury, London, E. C., England.

D. SAUNDERS' SONS

21 Atherton St., Yonkers, N.Y.

▲▲▲

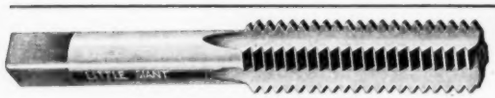
Makers of Pipe-Cutting, Threading and Tapping Machines.

▲▲▲

Pipe Cutter Circular for the asking.

Patent Wheel Pipe Cutter

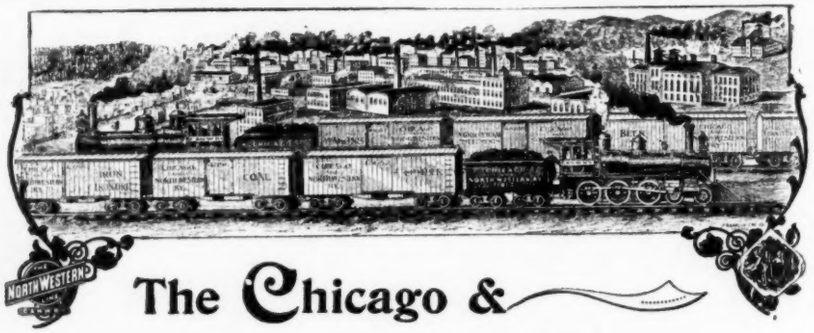
shown above combines simplicity with strength and lightness. Easily adapted to various sizes of pipe, rolling instead of sliding motion, no loose parts to become detached and mislaid. All wearing surfaces are of tool steel, hardened. Less friction of parts than any other pipe cutter made.



FINE TAPS

OF EVERY DESCRIPTION.

Manufactured by WELLS BROS. & CO., Greenfield, Mass., U. S. A.



The Chicago & North-Western Railway

REACHING with its 7,966 miles of road the famous Water Powers, Coal Fields, Iron Ore Ranges, Hard and Soft Lumber Districts located in Illinois, Wisconsin, Michigan, Iowa, Minnesota, South Dakota, North Dakota, Nebraska and Wyoming, and by traffic arrangements with other railways, 7,350 stations located on 41,000 miles of railroad (one-ninth of the entire railroad mileage of the world, and one-fourth of the railroad mileage of the United States), has on its line more industries than any other western railroad.

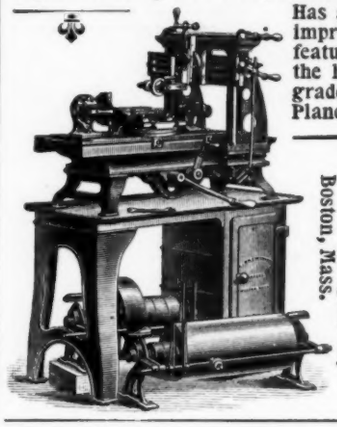
Manufacturers contemplating moving or establishing branch factories in the West are requested to inquire what we can offer them before locating elsewhere.

H. R. McCULLOUGH, GENERAL FREIGHT AGENT, CHICAGO.

Power or Hand

PLANER For Model Makers' Experimental Work.

Capable of doing the Best and Finest Work.



Has all the improved features of the highest grade Planers.

Manufactured by A. J. WILKINSON & CO. 184 Washington St., Boston, Mass.

We manufacture a complete line of

DRILLS

for light work, one or more SPINDLES, hand or automatic feed, of thorough workmanship and strictly up to date.

Prompt delivery on regular styles.

New Catalogue on application.

DWIGHT SLATE MACHINE CO.

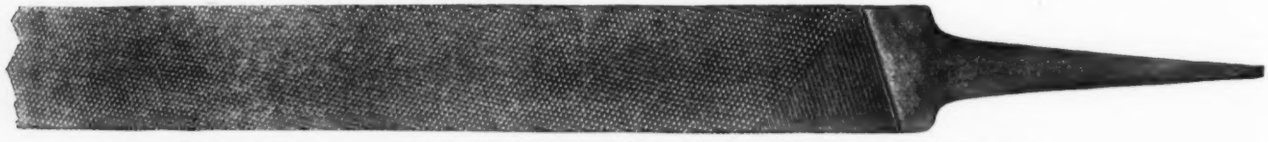
HARTFORD, CONN.

The reputation of our gears for superior excellence is now firmly established. Our Patent Raw Hide Bushings, though not as yet so well known, are equally meritorious. Inquire about them.

THE NEW PROCESS RAW HIDE CO.,

SYRACUSE, N. Y., U. S. A.

ARCADE FILES are made from the Finest Crucible Steel, and are far superior in CUTTING AND WEARING qualities to the cheap brands made from OPEN HEARTH STEEL.



Look at this file lengthwise in a slanting direction, the irregular lines show wherein Arcade Files excel.

We guarantee our files to cut faster and wear longer than any on the market, and will send to any responsible party, one dozen of our Arcade Files with Weed's Improved Increment Cut, and if, after test, they are not found to be the best files ever used, we will make no charge.

97 Chambers Street, New York.
118 Lake Street, Chicago, Ill.

The Arcade File Works,
Works: Anderson, Ind.

Makers of WEED'S PAT. INCREMENT CUT FILES

An interesting souvenir, Facts and Suggestions about Files, sent on request. New York office only.

Index to Advertisers.

	PAGE
Abbott, Wheelock & Co	45
Acme Machinery Co	16
Adt & Son, John	44
Albro-Clem Elevator Co	42
Almond, T. R	44
American Gas Furnace Co	2
American Injector Co	42
Ames Iron Works	46
Arcade File Works	2
Armstrong Bros. Tool Co	6
Armstrong Mfg. Co	44
Aurora Tool Works	42
Bacon, L. Seward	6
Backus Water Motor Co	46
Baird & Co., Henry Carey	7
Ball-Bearing Co., The	13
Barker & Co., William	7
Barnes Co., W. F. & John	46
Bates, Henry H	45
Baush & Harris Machine Tool Co	47
Besly & Co., Chas. H	41
Bethlehem Foundry and Machine Co	42
Betts Machine Co	6
Bickford Drill and Tool Co	48
Bilgram, Hugo	9
Blaisdell & Co., P	43
Bliss Co., E. W	1 and 7
Boston Gear Works	44
Box 62	42
Bradford Mill Co., The	11
Bremer Machine Co., Godfrey J	8
Brown & Sharpe Mfg. Co	48
Buffalo Forge Co	47
Builders Iron Foundry	4
Bullard Machine Tool Co	5
Card Electric Motor & Dynamo Co	45
Chicago & Northwestern Railway	2
Cincinnati Milling Machine Co	47
Cleveland Machine Screw Co	42
Cleveland Twist Drill Co	43
Coburn Trolley Track Mfg. Co., The	8
Coffin & Leighton	45
Comstock, Wm. T	45
Columbia University	41
Conover Mfg. Co	7
Coshocton Foundry Co., The	3
Crescent Steel Co	43
Crocker-Wheeler Electric Co	15
Cumberland Iron & Steel Shafting Co	44
Curtis & Curtis	10
Cushman Chuck Co	41
Dallett & Co., Thos. H	4
Davis, W. P	16
Davis & Egan Mach. Tool Co	45
Dawson & Goodwin	13
Deane Steam Pump Co	16
Detrick & Harvey Machine Co	41
Diamond Machine Co	41
Diechman & Sohn, Gustav	3
Dietz, Schumacher & Boye	41
Dixon Crucible Co., Joseph	1 and 45
Dwight Slate Machine Co	2
Dyer & Driscoll	10
Erlandsen, J	45
Evans Friction Cone Co	45
Fay & Co., J. A	3
Ferracute Machine Co	10
Fifield Tool Co	48
Fish Machine Works, H. C	9
Fitchburg Machine Works	13
Flather Co	47
Foote, Barker & Co	3
Forbes & Co., W. D	4
Fox Machine Co	42
Frick Co., The	46
Garvin Machine Co., The	8 and 16
General Electric Co	43
Goetze, Otto	10
Goodyear, S. W	42
Gould & Eberhardt	42
Grant Gear Works	3 and 7
Gray Co., G. A	16
Hamilton Machine Tool Co	15
Harrington & King Perforating Co	48
Harrington, Son & Co., E	4
Hartford Steam Boiler Insp. and Ins. Co	10
Hendey Machine Co	39 and 48
Henley & Co., N. W	38
Hill, Clarke & Co	6
Hoggson & Pettis Mfg. Co	41
Horton & Son Co., E	41
Hurlbut-Rogers Machine Co	47
Hyatt Roller Bearing Co	4
Ingersoll Milling Machine Co	42
International Correspondence Schools	6
Jenkins Bros	4
Johnson Co., The	7
Johns Mfg. Co., H. W	47
Jones & Co., B. M	44
Jones & Lamson Machine Co	48 and 16
Kane & Co., Thomas	45
Kelly & Jones Co., The	46
Keuffel & Esser Co	41
Keystone Engine and Machine Works	46
King Mfg. Co	7
Landis Bros	4
LeCount, Wm. G	3
Leland & Faulconer Mfg. Co	44
Lodge & Shipley Machine Tool Co	7 and 47
Long & Allstatter Co	3
Lorain Foundry Co., The	45
Machinists' Supply Co	4
Maris Bros	47
McCabe, J. J	8
McFadden Co	10
Miner & Peck Mfg. Co	47
Montgomery & Co	42
Morse Twist Drill & Machine Co	4
Mossberg Mfg. Co	9
National Chuck Co	41
National Machinery Co	41
National Pipe Bending Co	43
New Doty Mfg. Co	13
New Haven Mfg. Co	44
New Process Raw Hide Co	2
Newton Machine Tool Works	3
Nicholson File Co	43
Niles Tool Works Co	16
Niles Tool Works Co., N. Y. Branch	8
Norman Co., J. J	46
Norton Emery Wheel Co	44
Oneida Mfg. Chuck Co	41
Ott, Mergenthaler & Co	8
Otto Gas Engine Works	46
Patterson, Gottfried & Hunter	6
Peerless Drilling Compound Co., The	7
Pedrick & Ayer Co	48
Penberthy Injector Co	42
Pierce Engine Co	46
Place Machine Co., George	8
Pneumatic Engineering Co	43
Pratt & Whitney Co	40
Pratt Chuck Co	41
Prentiss Tool & Supply Co	8
Pryibil, P	11 and 43
Purdue University	42
Quint, A. D	8
Q. and C. Co	6
Reed Co., F. E	40
Replogle Governor Works, The	11
Roots, P. H. & F. M	47
Saunders' Sons, D	2
Sawyer Tool Co	8
Sebastian Lathe Co	13
Sebastian-May Co	7
Sellers & Co., Inc., Wm	16
Seneca Falls Mfg. Co	7
Shriver & Co., T	3
Sibley & Ware	11
Skinner Chuck Co	41
Slocomb & Co., J. T	8
Springfield Gas Engine Co., The	46
Standard Tool Co	43
Stark, John	43
Stiles & Fladd Press Co., The	9
Sterling Emery Wheel Mfg. Co	43
Stover Novelty Works	3
Strelinger & Co., Chas. A	4
Sturtevant Co., B. F	4
Stuart's Foundry & Machine Works, R. J	48
Taunton Locomotive Mfg. Co	43
Taylor-Rice Engineering Co	47
Timolat, J. G	44
Toledo Machine & Tool Co	4
Toomey, Frank	8
Trenton Iron Co., The	7
Trump Bros. Machine Co	44
Tuerk Hydraulic Power Co	7
Warner & Swasey	48
Waterbury-Farrel F'dry & Mach. Co	47
Waterbury Machine Co., The	41
Watson-Stillman Co., The	6
Webster Mfg. Co	11
Webster & Perks Tool Co	10
Wedderburn & Co., John	48
Wells Bros. & Co	2
Weston Engine Co	46
Wetherill Machine Co., The James P	44
Whiton Machine Co., D. E	41
Wiley & Sons, John	48
Wiley & Russell Mfg. Co	46
Wilkinson & Co., A. J	2
Wilkinson Co., The	7
Wilson, W. A	8
Wolverine Motor Works	6
Worcester Machine Screw Co	46
Wyke & Co., J	9
Wyman & Gordon	48

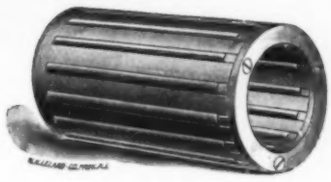


FIG. 2.

ROLLER BEARINGS.

Wonderful results in durability and

POWER SAVED.

Rolling Mill Owners, increase the capacity of your mills by applying

ROLLER BEARINGS.

We are prepared to furnish Bearings for all sizes of Journals. Write for Stock List.

Send six cents stamps for our 1896 Catalogue showing latest improvements in Rolling Mills, Automatic Drop Presses and Power Presses.

MOSSBERG M'F'G CO.,
ATTLEBORO, MASS.

ENGINE LATHES.

14 IN. TO 38 IN.

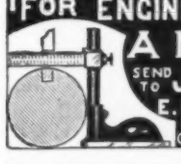
Heavy, Stiff, Powerful, Great Range of Feeds.

CIRCULARS ON APPLICATION.

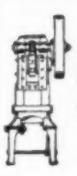
H. C. FISH MACHINE WORKS,
WORCESTER, MASS.

BEVEL GEARS

Cut Theoretically Correct.
Special facilities for cutting worm wheels.
HUGO BILGRAM,
Machinist,
440 N. 12th St., Phila., Pa.



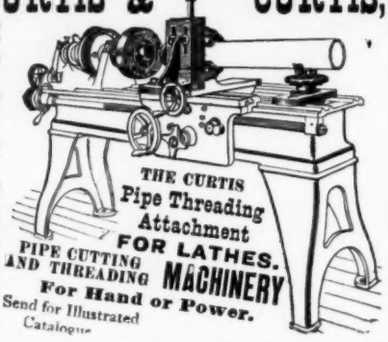
PAT. KEY-SEAT SETTING GAUGE FOR ENGINEERS & MACHINISTS
A NEW TOOL
SEND TO J. WYKE & CO.
E. BOSTON, MASS. U.S.A.
FOR LISTS OF THIS AND OTHER IMPROVED TOOLS.



Drop Hammers, Presses, Special Mach'y Dies.
THE STILES & FLADD PRESS CO.,
WATERTOWN, N. Y.

CURTIS & CURTIS,

66 Garden St., Bridgeport, Ct.



THE CURTIS Pipe Threading Attachment FOR LATHES. PIPE CUTTING AND THREADING MACHINERY For Hand or Power.

Send for Illustrated Catalogue

DYER & DRISCOLL,
PATENT SOLICITORS, 36 WALL ST., N. Y.

Have done all my patent soliciting work, both for this and foreign countries, continuously for the past fourteen years.

Thomas A. Edison

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.

HARTFORD, CONN.

J. M. ALLEN, President.
WM. B. FRANKLIN, Vice-President.
F. B. ALLEN, Second Vice-President.
J. B. PIERCE, Secretary and Treasurer.

Automatic Solid Die Bolt.
THREADING MACHINES.
Two Styles. Four Sizes.
Send for Catalogue "A."
WEBSTER & PERKS TOOL CO.
Cor. Spring and Monroe Sts., Springfield, Ohio.

McFADDEN COMPANY,
TAPS & DIES · VISES · TWIST DRILLS · CHUCKS · MACHINE SCREWS · LATHES · FILES · STEEL · TOOLS · STUBS
TOOLS
No. 722 Arch St., PHILADELPHIA, PA.

SPECIAL PRESSES AND DIES
FOR ALL KINDS OF BICYCLE WORK.
FERRACUTE MACHINE CO.
New Catalogue. BRIDGETON, N. J., U. S. A.

RUST
ON BRIGHT METAL SURFACES ABSOLUTELY PREVENTED DURING MANNOCITIN
ENDORSED BY LEADING FIRMS
WRITE FOR SAMPLE & PAMPHLET
O. GOETZE 110 BROADST. N.Y.

Buyers' Finding List.

Adding Machines.
Grant Calculating Machine Co., Boston, Mass.

Air Compressors.
Rand Drill Co., New York.

Asbestos Cement Felting.
Johns Mfg. Co., H. W., New York.

Balls, Steel.
Cleveland Machine Screw Co., Cleveland, O.

Bearings, Anti-Friction.
Ball Bearing Co., The, Boston, Mass.
Hyatt Roller Bearing Co., Newark, N. J.
Mossberg Mfg. Co., Attleboro, Mass.

Belt Dressing.
Dixon Crucible Co., Joseph, Jersey City, N. J.

Bicycle Tools.
Bickford Drill & Tool Co., Cincinnati, O.
Bliss Co., E. W., Brooklyn, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Mach. Screw Co., Cleveland, O.
Davis & Egan Mach. Tool Co., Cincinnati, O.
Ferracute Machine Co., Bridgeton, N. J.
Garvin Machine Co., New York.
Hill, Clarke & Co., Boston, Mass.
Lodge & Shipley Machine Tool Co., Cincinnati, O.
McCabe, J. J., New York.
Mossberg Mfg. Co., Attleboro, Mass.
Niles Tool Works Co., Hamilton, O.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Wilkinson Co., The, Chicago, Ill.

Blowers.
American Gas Furnace Co., New York
Buffalo Forge Co., Buffalo, N. Y.
Cooke & Co., New York.
Roots, P. H. & F. M., Connersville, Ind
Sturtevant Co., B. F., Boston, Mass.

Boilers, Steam.
Weston Engine Co., Painted Post, N. Y.

Bolt Cutters.
Acme Machinery Co., Cleveland, O.
Davis & Egan Machine Tool Co., Cincinnati, O.
Dawson & Goodwin, Chicago, Ill.
Detrick & Harvey Machine Co., Baltimore, Md.
Hill, Clarke & Co., Boston, Mass.
National Machinery Co., Tiffin, O.
Pratt & Whitney Co., Hartford, Conn
Prentiss Tool & Supply Co., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Strelinger & Co., Chas. A., Detroit, Mich
Webster & Perks Tool Co., Springfield, O.
Wells Bros. & Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Books.
Audel & Co., Theo., New York.
Baird & Co., Henry Carey, Philadelphia, Pa.
Comstock, Wm. T., New York.
Grant Gear Works, Boston, Mass.
Henley & Co., Norman W., New York.
Strelinger & Co., Chas. A., Detroit, Mich.
Wiley & Sons, John, New York.

Boring and Turning Mills.
Betts Machine Co., Wilmington, Del.
Bickford Drill & Tool Co., Cincinnati, O.
Bullard Machine Tool Co., Bridgeport, Conn.
Davis & Egan Machine Tool Co., Cincinnati, O.
Niles Tool Works Co., Hamilton, O.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Inc., William, Philadelphia, Pa.

Brass Work, Special.
Nolte Brass Co., Springfield, O.

Bushings.
New Process Raw Hide Co., Syracuse, N. Y.

Calipers.
Brown & Sharpe Mfg. Co., Providence, R. I.
Standard Tool Co., Athol, Mass.
Starrett, L. S., Athol, Mass.
Strelinger & Co., Chas. A., Detroit, Mich.
Wilkinson & Co., A. J., Boston, Mass.

Calorimeters.
Schaffer & Budenberg, Brooklyn, N. Y.

Castings, Brass.
Lorain Foundry Co., The, Lorain, Ohio.
Nolte Brass Co., Springfield, O.

Castings, Iron.
Builders Iron Foundry, Providence, R. I.
Burr & Houston Co., Brooklyn, N. Y.
Leland & Faulconer Mfg. Co., Detroit, Mich.
Lorain Foundry Co., The, Lorain, Ohio.
Shriver & Co., T., New York.

Castings, Phosphor Bronze.
Nolte Brass Co., Springfield, O.

Castings, Steel.
Johnson Co., The, Johnstown, Pa.

Cements, Etc.—Fire-proof
Johns Mfg. Co., H. W., New York.

Centering Drill.
Slocomb & Co., J. T., Providence, R. I.

Chucks, Drill.
Almond, T. R., Brooklyn, N. Y.
Cushman Chuck Co., Hartford, Conn.
Dawson & Goodwin, Chicago, Ill.

Chucks, Drill—Continued.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Horton & Son Co., E., Windsor Locks, Conn.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Oneida Mfg. Chuck Co., Oneida, N. Y.
Pratt Chuck Co., Clayville, N. Y.
Prentiss Tool & Supply Co., New York.
Skinner Chuck Co., New Britain, Conn.
Trump Bros. Machine Co., Wilmington, Del.
Wiley & Russell Mfg. Co., Greenfield, Mass.
Whiton Machine Co., D. E., New London, Conn.

Chucks, Lathe.
Cushman Chuck Co., Hartford, Conn.
Dawson & Goodwin, Chicago, Ill.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Horton & Son Co., E., Windsor Locks, Conn.
National Chuck Co., New York.
Oneida Mfg. Chuck Co., Oneida, N. Y.
Pratt & Whitney Co., Hartford, Conn.
Pratt Chuck Co., Clayville, N. Y.
Prentiss Tool & Supply Co., New York.
Skinner Chuck Co., New Britain, Conn.
Whiton Machine Co., D. E., New London, Conn.

Chucks, Tapping.
National Chuck Co., New York.

Clutches, Friction.
Bliss Co., E. W., Brooklyn, N. Y.
Evans Friction Cone Co., Boston, Mass.
New Haven Mfg. Co., New Haven, Conn.

Condensers.
Conover Mfg. Co., New York.

Counting Machines.
Durant, W. N., Milwaukee, Wis.

Couplings.
Patterson, Gottfried & Hunter, New York.
Stuart's Foundry and Machine Works, R. J., New Hamburgh, N. Y.

Coverings, Non-conducting Pipe & Boiler.
Johns Mfg Co., H. W., New York.

Cranes.
Harrington, Son & Co., E., Philadelphia, Pa.
Maris Bros., Philadelphia, Pa
Prentiss Tool & Supply Co., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

Cutting-Off Machines.
Armstrong Mfg. Co., The, Bridgeport, Conn.
Hill, Clarke & Co., Boston, Mass.
Hurlbut-Rogers Mach. Co., So. Sudbury, Mass.

Dies, Screw Cutting.
Acme Machinery Co., Cleveland, O.
Besly & Co., Chas. H., Chicago, Ill.
Detrick & Harvey Machine Co., Baltimore, Md.
Jones & Lamson Machine Co., Springfield, Vt.
Montgomery & Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Strelinger & Co., Chas. A., Detroit, Mich.
Taylor-Rice Engineering Co., Gloucester City, N. J.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Drawing Instruments, Etc.
Alteneder & Sons, T., Philadelphia, Pa.
Keuffell & Esser Co., New York.

Drilling Compound.
Peerless Drilling Compound Co., The, Utica, N. Y.

Drilling Machines.
Adt & Son, John, New Haven, Conn.
Aurora Tool Works, Aurora, Ind.
Barnes Co., W. F. & John, Rockford, Ill
Baush & Harris Machine Tool Co., Holyoke, Mass.
Betts Machine Co., Wilmington, Del.
Bickford Drill & Tool Co., Cincinnati, O.
Blaisdell & Co., P., Worcester, Mass.
Dallett & Co., Thos. H., Philadelphia, Pa.
Davis, W. P., Rochester, N. Y.
Davis & Egan Machine Tool Co., The, Cincinnati, O.
Dawson & Goodwin, Chicago, Ill.
Diechmann & Sohn, Gustav, Berlin, Germany
Dietz, Schumacher & Boye, Cincinnati, O.
Dwight Slate Machine Co., Hartford, Conn.
Fitchburg Machine Works, Fitchburg, Mass.
Foote, Barker & Co. Cleveland, O.
Fox Machine Co., Grand Rapids, Mich.
Garvin Machine Co., New York.
Gould & Eberhardt, Newark, N. J.
Harrington, Son & Co., E., Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Montgomery & Co., New York.
Mossberg Mfg. Co., Attleboro, Mass.
New Haven Mfg. Co., New Haven, Conn.
Newton Mach. Tool Works, Philadelphia, Pa.
Niles Tool Works Co., Hamilton, O.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Quint, A. D., Hartford, Conn.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Sibley & Ware, South Bend, Ind.
Stover Novelty Works, Freeport, Ill.
Strelinger & Co., Chas. A., Detroit, Mich.
Timolat, J. G., New York.
Warner & Swasey, Cleveland, O.
Wilkinson & Co., A. J., Boston, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Drill Gage.
Wyke & Co., J., East Boston, Mass.

Drill Rods.
Abbott, Wheelock & Co., Boston, Mass.

Drills, Twist.
Besly & Co., Chas. H., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, O.
Machinists' Supply Co., Chicago, Ill.
McFadden Co., Philadelphia, Pa.
Montgomery & Co., New York.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drop Forgings.
Transue & Williams, Alliance, O.
Wyman & Gordon, Worcester, Mass.

Dynamos.
Card Elec. Motor & Dynamo Co., Cincinnati, O.
Crocker-Wheeler Electric Co., New York.
General Electric Co., New York.
Roth Bros. & Co., Chicago, Ill.

Dynamo Brushes.
Wirt, Charles, Philadelphia, Pa.

Electric Machinery.
Card Elec. Motor & Dynamo Co., Cincinnati, O.
Crocker-Wheeler Electric Co., New York.
General Electric Co., New York.

Elevators.
Albro-Clem Elevator Co., Philadelphia, Pa.

Emery Wheels.
Besly & Co., Chas. H., Chicago, Ill.
Diamond Machine Co., Providence, R. I.
Montgomery & Co., New York.
Norton Emery Wheel Co., Worcester, Mass.
Sterling Emery Wheel Co., Tiffin, O.
Strelinger & Co., Chas. A., Detroit, Mich.

Engines, Gas and Gasoline.
Kane & Co., Thos., Chicago, Ill.
Norman Co., J. J., Chicago, Ill.
Otto Gas Engine Works, Philadelphia, Pa.
Pierce Engine Co., Racine, Wis.
Springfield Gas Engine Co., Springfield, O.
Webster Manufacturing Co., Chicago, Ill.
Wolverine Motor Works, Grand Rapids, Mich.

Engines, Steam.
Ames Iron Works, Oswego, N. Y.
Buffalo Forge Co., Buffalo, N. Y.
Forbes & Co., W. D., Hoboken, N. J.
Frick Co., The, Waynesboro, Pa.
Keystone Engine & Mach. Works, Phila., Pa.
Sturtevant Co., B. F., Boston, Mass.
Weston Engine Co., Painted Post, N. Y.
Wetherill Machine Co., James P., Chester, Pa.

Feed Water Heaters and Purifiers.
National Pipe Bending Co., New Haven, Conn.
Taunton Locomotive Mfg. Co., Taunton, Mass.

Files.
Arcade File Works, New York.
Besly & Co., Chas. H., Chicago, Ill.
Machinists' Supply Co., Chicago, Ill.
McFadden Co., Philadelphia, Pa.
Montgomery & Co., New York.
Nicholson File Co., Providence, R. I.
Strelinger & Co., Chas. A., Detroit, Mich.

Fire-proof Construction Materials.
Johns Mfg. Co., H. W., New York.

Forges.
Buffalo Forge Co., Buffalo, N. Y.
Sturtevant Co., B. F., Boston, Mass.
Wilkinson Co., The, Chicago, Ill.

Friction Cones.
Evans Friction Cone Co., Boston, Mass.

Furnaces.
American Gas Furnace Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.

Gages.
Brown & Sharpe Mfg. Co., Providence, R. I.
Coffin & Leighton, Syracuse, N. Y.
Pratt & Whitney Co., Hartford, Conn.
Taylor-Rice Engineering Co., Gloucester City, N. J.
Wyke & Co., J., East Boston, Mass.

Gauges, Pressure Recording.
Schaffer & Budenberg, Brooklyn, N. Y.

Gear Cutters.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gould & Eberhardt, Newark, N. J.
Grant Gear Works, Boston, Mass.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Whiton Mach. Co., D. E., New London Conn.

Gears.
Bilgram, Hugo, Philadelphia, Pa.
Boston Gear Works, Boston, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Grant Gear Works, Boston, Mass.
New Process Raw Hide Co., Syracuse, N. Y.
Shriver & Co., T., New York.

Governors.
Replogle Governor Works, The, Akron, O.

Graphite.
Dixon Crucible Co., Joseph, Jersey City, N. J.

Grinding and Polishing Machines.
Besly & Co., Chas. H., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Builders Iron Foundry, Providence, R. I.
Diamond Machine Co., Providence, R. I.
Garvin Machine Co., New York.
Hill, Clarke & Co., Boston, Mass.
Landis Bros., Waynesboro, Pa.
Leland & Faulconer Mfg. Co., Detroit, Mich.
Norton Emery Wheel Co., Worcester, Mass.
Place Machine Co., George, New York.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Strelinger & Co., Chas. A., Detroit, Mich.
Wells Bros. & Co., Greenfield, Mass.

Grinders, Center.
Barker & Co., William, Cincinnati, O.
Leland & Faulconer Mfg. Co., Detroit, Mich.
Trump Bros. Machine Co., Wilmington, Del.

Grinding Machine, Cock.
Foote, Barker & Co., Cleveland, O.

Grinding Machine, Cutter.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, O.
Davis & Egan Machine Tool Co., The, Cincinnati, O.
Dawson & Goodwin, Chicago, Ill.
Foote, Barker & Co., Cleveland, O.
Garvin Machine Co., New York.
Hill, Clarke & Co., Boston, Mass.
Norton Emery Wheel Co., Worcester, Mass.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.

Grinding Machines, Universal.
Brown & Sharpe Mfg. Co., Providence, R. I.
Landis Bros., Waynesboro, Pa.

Hack Saws.
Besly & Co., Chas. H., Chicago, Ill.
Montgomery & Co., New York.
Q. & C. Co., Chicago, Ill.
Stover Novelty Works, Freeport, Ill.
Strelinger & Co., Chas. A., Detroit, Mich.

Hammers, Drop.
Bliss Co., E. W., Brooklyn, N. Y.
Long & Allstatter Co., Hamilton, O.
Miner & Peck Mfg. Co., New Haven, Conn.
Mossberg Mfg. Co., Attleboro, Mass.
Stiles & Fladd Press Co., Watertown, N. Y.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.

Hammers, Power.
Bremer Machine Co., G. J., Kalamazoo, Mich.
Hill, Clarke & Co., Boston, Mass.

Hoists.
Harrington, Son & Co., E., Philadelphia, Pa.
Maris Bros., Philadelphia, Pa.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

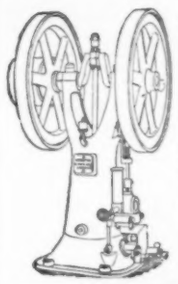
Hydraulic Machinery.
Diechmann & Sohn, Gustav, Berlin, Germany.
The Watson-Stillman Co., New York.

Injectors.
American Injector Co., Detroit, Mich.
Penberthy Injector Co., Detroit, Mich.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

Keyway Cutter.
Baker Bros., Toledo, O.

Lathes (see also Turret Lathes).
Barnes Co., W. F. & John, Rockford, Ill.
Blaisdell & Co., P., Worcester, Mass.
Bradford Mill Co., The, Cincinnati, O.
Brown & Sharpe Mfg Co., Providence, R. I.
Bullard Machine Tool Co., Bridgeport, Conn.
Davis, W. P., Rochester, N. Y.
Davis & Egan Machine Tool Co., The, Cincinnati, O.
Dawson & Goodwin, Chicago, Ill.
Diechmann & Sohn, Gustav, Berlin, Germany.
Dietz, Schumacher & Boye, Cincinnati, O.
Fifield Tool Co., Lowell, Mass.
Fish Machine Works, H. C., Worcester, Mass.
Fitchburg Machine Works, Fitchburg, Mass.
Flather & Co., Nashua, N. H.
Gould & Eberhardt, Newark, N. J.
Harrington, Son & Co., E., Philadelphia, Pa.
Hendey Machine Co., Torrington, Conn.
Hill, Clarke & Co., Boston, Mass.
Lodge & Shipley Machine Tool Co., Cincinnati, O.
McCabe, J. J., New York.
McFadden Co., Philadelphia, Pa.
New Doty Mfg. Co., Janesville, Wis.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., Hamilton, O.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Reed Co., F. E., Worcester, Mass.

(Continued on page 12.)

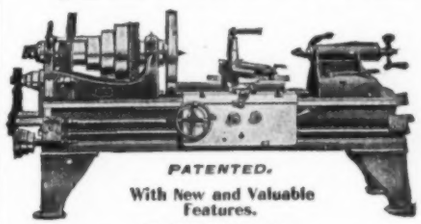


This beats Wind, Steam or Horse Power.
We offer the
WEBSTER 2 1-2 ACTUAL HORSEPOWER
GAS ENGINE
For $150, less 10 per cent. discount for cash. Built on the interchangeable plan. Built of the best material. Made in lots of 100, therefore, we can make the price. Boxed for shipment, weight 800 pounds. Made for Gas or Gasoline.
Write for Special Catalog.
WEBSTER MFG. CO.
1079 W. 15th St., CHICAGO.

WATER POWER GOVERNED

for electrical and other work, with results equal to the best Corliss engine practice.
Send for Illustrated Catalogue "A."
THE REPLOGLE GOVERNOR WORKS, Akron, O., U. S. A.
MARK A. REPLOGLE, Chief Engineer.

New 20-in.
Combination Drill,
A most valuable machine for general use. Ask for Drill Book C.
Sibley & Ware, S. Bend, Ind.

HIGH CLASS ENGINE LATHES.

PATENTED.
With New and Valuable Features.
MADE ONLY BY
THE BRADFORD MILL COMPANY,
Catalogue "A" describes our Lathes, sent on application. CINCINNATI, OHIO, U. S. A.
LONDON—Chas. Churchill & Co., Ltd., 21 Cross st., Finsbury.
NEW YORK—Garvin Machine Co., Spring and Varick Sts.

O SAY
DID YOU SEE THE
SMOOTHBORE
HANGERS?
They are reamed on a special machine which leaves the bearing exceedingly smooth and very accurate. They hold sufficient oil for three to six months. Durability and good workmanship guaranteed.

NEAT DESIGNS. CORRECT PROPORTIONS.
ACCURATE WORKMANSHIP.
P. PRYIBIL,
512 to 524 West 41st Street,
NEW YORK.
Cable "Pryibil, Newyork." Use A. B. C. Code.

Foreign Orders.

United States Consular Agent Carpenter, at Furth, Bavaria, has just made a report to our Government urging our manufacturers to make some attempt to secure the profitable trade in that country.

He states that anything branded "American" is considered the best, and though all the tools offered as such are inferior imitations they bring a higher price.

Mr. Carpenter ends his report, as follows:

"The great difficulty with American manufacturers and dealers is that they waste their time shouting for a home market, when there is no home market and can never be so long as the supply so greatly exceeds the demand. The markets they want are here and elsewhere in the world, and are not so hard to find if they would only take the time to hunt them up."

Quite a number of our advertisers are enjoying a growing foreign trade, and have secured it largely, and in some cases solely, through intelligent advertising in the AMERICAN MACHINIST.

Two German firms are advertising in this paper for their home trade—there is no technical paper like this on the Continent of Europe—and the chief engineers and mechanics of large concerns there are close readers of this publication.

A word to the wise is sufficient.

THE MANAGEMENT.

BUYERS' FINDING LIST—Continued.

Lathes—Continued.

Sebastian Lathe Co., Cincinnati, O.
Sebastian-May Co., Sidney, O.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Stark, John, Boston, Mass.

Machinists' Tools and Supplies.

Machinists' Supply Co., Chicago.
Montgomery & Co., New York.
Sawyer Tool Co., Athol, Mass.
Standard Tool Co., Athol, Mass.
Starrett Co., The L. S., Athol, Mass.

Milling Cutters.

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, O.
Erlandsen, J., New York.
Garvin Machine Co., New York.
Ingersoll Milling Machine Co., Rockford, Ill.
Reinecker, J. E., Chemnitz-Gablenz, Germany.
Starrett, L. S., Athol, Mass.

Milling Machines.

Bliss Co., E. W., Brooklyn, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, O.
Davis & Egan Machine Tool Co., The, Cincinnati, O.
Forbes & Co., W. D., Hoboken, N. J.
Garvin Machine Co., New York.
Hill, Clarke & Co., Boston, Mass.
Ingersoll Milling Machine Co., Rockford, Ill.
Leland & Faulconer Mfg. Co., Detroit, Mich.
McCabe, J. J., New York.
Newton Mach. Tool Works, Philadelphia, Pa.
Niles Tool Works Co., Hamilton, O.
Niles Tool Works Co., New York.
Ott, Mergenthaler & Co., Baltimore, Md.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Reed Co., F. E., Worcester, Mass.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

Motors, Electric.

Card Elec. Motor & Dynamo Co., Cincinnati, O.
Crocker-Wheeler Electric Co., New York.
Dallett & Co., Thos. H., Philadelphia, Pa.
General Electric Co., New York.
Roth Bros. & Co., Chicago, Ill.

Motors, Water.

Tuerk Hydraulic Power Co., New York.

Needle Wire.

Abbott, Wheelock & Co., Boston, Mass.

Packing.

Jenkins Bros., New York
Johns Mfg. Co., H. W., New York.

Paints, Fire-proof.

Johns Mfg. Co., H. W., New York.

Patent Attorneys.

Bacon, L. Seward, Washington, D. C.
Bates, H. H., Washington, D. C.
Dyer & Driscoll, New York.
Wedderburn & Co., John, Washington, D. C.

Pattern Letters.

Montgomery & Co., New York.
Wells, Heber, New York.

Perforated Metals.

Harrington & King Perforating Co., The, Chicago, Ill.

Phosphor Bronze.

Phosphor Bronze Smelting Co., Ltd., Philadelphia, Pa.

Pipe, Bent.

National Pipe Bending Co., New Haven, Conn.

Pipe Cutting and Threading Machines.

Armstrong Mfg. Co., The, Bridgeport, Conn.
Curtis & Curtis, Bridgeport, Conn.
Dawson & Goodwin, Chicago, Ill.
Detrick & Harvey Machine Co., Baltimore, Md.
Hill, Clarke & Co., Boston, Mass.
National Machinery Co., Tiffin, O.
Saunders' Sons, D., Yonkers, N. Y.
Wells Bros. & Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Pipe Fittings.

Kelly & Jones Co., The, New York.

Planers.

Betts Machine Co., Wilmington, Del.
Davis, W. P., Rochester, N. Y.
Davis & Egan Machine Tool Co., The, Cincinnati, O.
Dawson & Goodwin, Chicago, Ill.
Detrick & Harvey Mach. Co., Baltimore, Md.
Fitchburg Machine Works, Fitchburg, Mass.
Flather & Co., Nashua, N. H.
Garvin Machine Co., New York.
Gray Co., G. A., Cincinnati, O.
McCabe, J. J., New York.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., Hamilton, O.

Planers—Continued.

Niles Tool Works Co., New York.
Pedrick & Ayer Co., Philadelphia, Pa.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Wilson, W. A., Rochester, N. Y.

Polishing Wheels.

Builders Iron Foundry, Providence, R. I.

Presses, Dies, Etc.

Adt & Son, John, New Haven, Conn.
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Machine Co., G. J., Kalamazoo, Mich.
Ferracute Machine Co., Bridgeton, N. J.
McCabe, J. J., New York.
Mossberg Mfg. Co., Attleboro, Mass.
New Doty Mfg. Co., Janesville, Wis.
Stiles & Fladd Press Co., Watertown, N. Y.
Toledo Machine & Tool Co., The, Toledo, O.

Pumping Machinery.

Deane Steam Pump Co., Holyoke, Mass.
Wetherill Machine Co., James P., Chester, Pa.

Punches and Shears.

Bliss Co., E. W., Brooklyn, N. Y.
Bremer Machine Co., G. J., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Davis & Egan Machine Tool Co., Cincinnati, O.
Long & Allstatter Co., Hamilton, O.
McCabe, J. J., New York.
Mossberg Mfg. Co., Attleboro, Mass.
New Doty Mfg. Co., Janesville, Wis.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Watson-Stillman Co., The, New York.

Raw Hide.

New Process Raw Hide Co., Syracuse, N. Y.

Reamers.

Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Ott, Mergenthaler & Co., Baltimore, Md.
Pratt & Whitney Co., Hartford, Conn.
Taylor-Rice Engineering Co., Gloucester City, N. J.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Riveting Machine.

Adt & Son, John, New Haven, Conn.

Rock Drills.

Rand Drill Co., New York.

Rolling Mills.

Mossberg Mfg. Co., Attleboro, Mass.

Roofing, Asbestos.

Johns Mfg. Co., H. W., New York.

Rules, Graduated Steel.

Coffin & Leighton, Syracuse, N. Y.
Darling, Brown & Sharpe, Providence, R. I.
Sawyer Tool Co., Athol, Mass.
Standard Tool Co., Athol, Mass.
Starrett Co., L. S., Athol, Mass.
Wyke & Co., J., East Boston, Mass.

Rust Preventing Compound.

Goetze, O., New York.

Saws.

Q. & C. Co., Chicago, Ill.

Sawing Machines, Metal.

Q. & C. Co., Chicago, Ill.

Schools.

Columbia University, New York.
International Correspondence Schools, Scranton, Pa.
Purdue University, Lafayette, Ind.
Rose Polytechnic Institute, Terre Haute, Ind.
Worcester Polytechnic Institute, Worcester Mass.

Screw Machines (see Turret Lathes).

Screws, Machine.

Cleveland Machine Screw Co., Cleveland, O.
Flather & Co., Nashua, N. H.
McFadden Co., Philadelphia, Pa.
Worcester Machine Screw Co., Worcester, Mass.

Screw Plates.

Machinists' Supply Co., Chicago, Ill.
Wells Bros., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.
Wilkinson Co., The, Chicago, Ill.

Screws.

Cleveland Machine Screw Co., Cleveland, O.
Worcester Machine Screw Co., Worcester, Mass.

Separators, Steam.

Keystone Engine and Machine Works, Philadelphia, Pa.

Shafting, Hangers, Etc.

Pryibil, P., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

BUYERS' FINDING LIST—Continued.

Shapers.
Betts Machine Co., Wilmington, Del.
Davis & Egan Machine Tool Co., The, Cincinnati, O.
Dawson & Goodwin, Chicago, Ill.
Fitchburg Machine Works, Fitchburg, Mass.
Flather & Co., Nashua, N. H.
Fox Machine Co., Grand Rapids, Mich.
Garvin Machine Co., New York.
Gould & Eberhardt, Newark, N. J.
Hendey Machine Co., Torrington, Conn.
Hill, Clarke & Co. Boston, Mass.
McCabe, J. J., New York.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., Hamilton, O.
Pratt & Whitney Co., Hartford, Conn.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

Shears.
Bliss Co., E. W., Brooklyn, N. Y.

Shears, Rotary.
Bethlehem Fdy. & Machine Co., South Bethlehem, Pa.

Sight Feed Lubricators.
Kelly & Jones Co., The, New York.

Slotters.
Betts Machine Co., Wilmington, Del.
Niles Tool Works Co., Hamilton, O.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

Special Machinery.
Bremer Machine Co., G. J., Kalamazoo, Mich.
Ott, Mergenthaler & Co., Baltimore, Md.
Toledo Machine & Tool Co., The, Toledo, O.

Steel.
Abbott, Wheelock & Co., Boston, Mass.
Crescent Steel Co., Pittsburgh, Pa.
Johnson Co., The, Johnstown, Pa.
Jones & Co., B. M., Boston, Mass.
McFadden Co., Philadelphia, Pa.
Trenton Iron Co., The, Trenton, N. J.

Taps and Dies.
McFadden Co., Philadelphia, Pa.
Wiley & Russell Mfg. Co., Greenfield, Mass.
Wilkinson Co., The, Chicago, Ill.

Threading Machines.
Webster & Perks Machine Tool Co., Springfield, O.

Tool Holders.
Armstrong Bros.' Tool Co., Chicago, Ill.
Gould & Eberhardt, Newark, N. J.

Tramways, Overhead.
Coburn Trolley Track Mfg. Co., Holyoke, Mass.

Tubing, Flexible.
Almond, T. R., Brooklyn, N. Y.

Turret Lathes (Screw Machines).
Bradford Mill Co., The, Cincinnati, O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Machine Tool Co., Bridgeport, Conn.
Cleveland Machine Screw Co., Cleveland, O.
Davis & Egan Machine Tool Co., The, Cincinnati, O.
Dawson & Goodwin, Chicago, Ill.
Garvin Machine Co., New York.
Hill, Clarke & Co., Boston, Mass.
Jones & Lamson Machine Co., Springfield, Vt.
Lodge & Shipley Machine Tool Co., Cincinnati, O.
McCabe, J. J., New York.
Niles Tool Works Co., Hamilton, O.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Warner & Swasey, Cleveland, O.

Valves.
Jenkins Bros., New York.
Kelly & Jones Co., The, New York.

Ventilating Fans.
Backus Water Motor Co., Newark, N. J.
Buffalo Forge Co., Buffalo, N. Y.
Sturtevant & Co., B. F., Boston, Mass.

Vises.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
McFadden Co., Philadelphia, Pa.
Niles Tool Works Co., New York.
Place Machine Co., George, New York.
Strelinger & Co., Chas. A., Detroit, Mich.
Wilkinson Co., The, Chicago, Ill.
Wyman & Gordon, Worcester, Mass.

Water Motors.
Backus Water Motor Co., Newark, N. J.
Tuerk Hydraulic Power Co., New York.

Wire Machinery.
Adt & Son, John, New Haven, Conn.
Goodyear, S. W., Waterbury, Conn.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Waterbury Machine Co., Waterbury, Conn.

Wire Rope.
Trenton Iron Co., The, Trenton, N. J.

Woodworking Machinery.
Barnes Co., W. F. & John, Rockford, Ill.
J. A. Fay & Egan Co., Cincinnati, O.
Pryibil, P., New York.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.

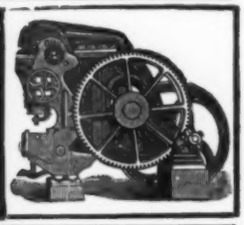
Wrenches.
Machinists' Supply Co., Chicago,

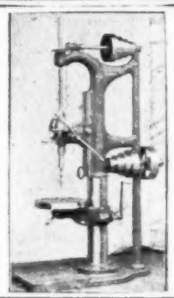
SPEAKING OF LATHES!

We are building them in various sizes from 10 inch to 24 inch swing, in various lengths, both engine and speed lathes. Our designs are the latest and most approved, while the workmanship, material and finish are of the highest order. Our catalogue will tell you all about them, as well as of our planers, shapers, drills and other tools and supplies.

SEBASTIAN LATHE CO.,
117-119 CULVERT ST., CINCINNATI, OHIO.

PUNCHING AND SHEARING MACHINERY
AND BOILER MAKERS ROLLS.
NEW DOTY MANUFACTURING CO.
JANESVILLE WISCONSIN.





18-INCH DRILL No. 1.

FITCHBURG
CANC
RADIAL
UPRIGHT
HORIZONTAL
DRILLS

FITCHBURG MACHINE WORKS,
FINE MACHINE TOOL BUILDERS,
CAT. E. FITCHBURG, MASS.

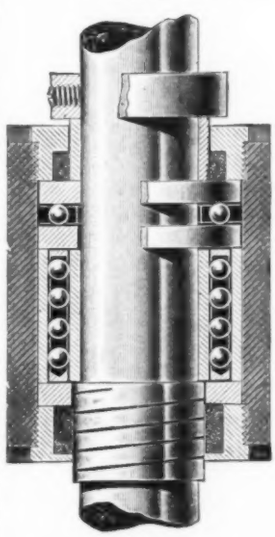
DAWSON & GOODWIN,
CHICAGO, ILL.

IRON AND BRASS WORKING MACHINERY.

Engine Lathes, Screw Machines,
Metal Planers, Metal Shapers,
Drill Presses, Milling Machines.

WRITE FOR CATALOGUE AND PRICES.

TRADE "HUB" MARK **BALL-BEARINGS**



Type E,
Or Combination Single Radial and Single "End-Thrust" Bearing.
(For shafts extending vertically through the box. Takes the thrust in but one direction.)

For General Machine Construction.

ENORMOUS SAVING OF FRICTION AND POWER TRANSMISSION.
RADIAL (CYLINDRICAL) AND END-THRUST TYPES,
FOR STANDARD AND SPECIAL SIZES.

Balls Confined in Cages and Handled as ONE PIECE. No Wear. No Adjustment. No Care. Easily Applied.
No Wear on Either Shaft or Box. Balls Have LATERAL TRAVERSE and Roll Only on Hardened Steel, REMOVABLE SURFACES.

PATENTED AUGUST 18, 1890; APRIL 7, 1891; JANUARY 5, 1892; AND JULY 11, 1893.
CAUTION: INFRINGEMENT OF PATENTS WILL BE VIGOROUSLY PROSECUTED.
DESCRIPTIVE CIRCULAR WITH FULL INFORMATION, MAILED FREE ON APPLICATION.

THE BALL-BEARING CO.,
Main Office: WATSON STREET,
(NEAR NORTHAMPTON)
BOSTON, MASS.

PLEASE MENTION AMERICAN MACHINIST.

To Our Small Space Advertisers

The largest machine tool manufacturers in America are enjoying a good foreign business. This trade is satisfactory and profitable.

Do you want some of this kind of trade?

The AMERICAN MACHINIST can help you get it.

The paper has a large foreign subscription list among the responsible heads of great concerns.

Bid for their trade.

You can best do this by taking occasional large space ads—make a good showing of one or more tools.

Don't name the tool in medium sized type, and put your name and address in larger type.

Illustrate the tool and tell all you can about it. Tell what it does; give time and cost of work. Tell how it does it. Tell how fast it runs, what size belt it takes, how much it weighs, what it costs.

In fact, talk shop sense just the same as you would if a foreigner called at your place to look at the tool.

The information will save much correspondence, and hasten sales.

The AMERICAN MACHINIST is credited, the world over, as being the one authority on American machine matters.

We strongly urge our small space users to try this method of introducing and explaining their machines and tools.

Perpetual small space in such a medium as ours is poor economy. It creates the impression that the advertiser is a small concern. Dissipate such impressions by special, live ads—they create new interest in your products.

Our flat rate lets you try any ad, any time, at yearly rates. Special rates for large space used in a year. Write to

American Machinist Pub. Co.,

New York.

Don't forget that foreign trade.

What do you know about Electrically Driven Machinery ? ? ? ? ?

▲ ▲ ▲

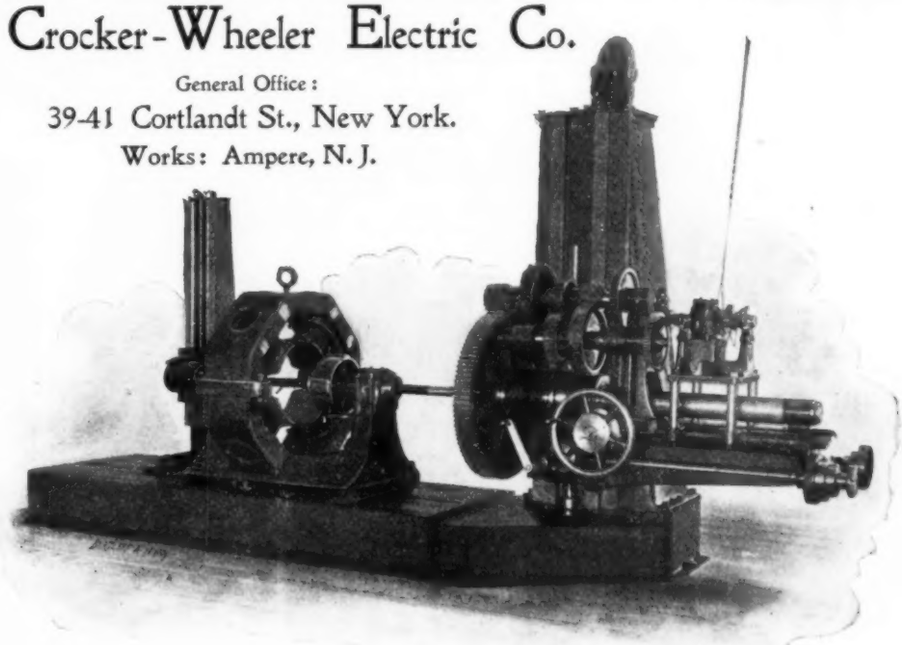
We are the recognized leaders in Dynamos and Motors for driving machinery of all kinds. This class of work is our specialty and we do more of it than all other companies.

▲ ▲ ▲

Send to N. Y. Office for finely illustrated pamphlet A, showing various applications of electrical power interesting to all machinery builders and users.

Crocker-Wheeler Electric Co.

General Office:
39-41 Cortlandt St., New York.
Works: Ampere, N. J.



Size 1 Motor Built on Boring Head, Supplying Power to 10-ton Boring Mill. Speed Changes Obtained by Gearing.

HAMILTON

12 in., 16 in., 20 in., 21 in., 24 in., 28 in., 32 in., 36 in., 40 in. and 44 in.

Our New Automatic Stop
is only one of the

EARMARKS

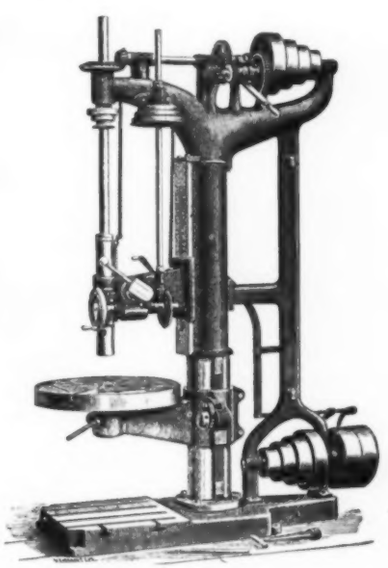
Indicating the general up-to-date character of our Drill Presses.

There are many others which commend the tools to the wide-awake manufacturer and careful buyer.

◆◆◆◆◆

ONE CENT

Invested in a postal card will get you our NEW CATALOGUE, just out.



THE HAMILTON MACH. TOOL CO.
Zimmerman Avenue,
HAMILTON, OHIO.

DRILLS.

Niles Tool Works Co. Hamilton, O., U.S.A.

Main Office and Works.

Engineers and Builders.

Branches: New York, Boston, Chicago, Philadelphia, Pittsburgh.

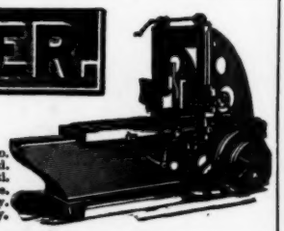
Machine Tools. All Types and Sizes.

THE GRAY PLANER.

MANUFACTURED BY
THE G. A. GRAY CO.,
CINCINNATI, OHIO.

THE FOLLOWING MACHINERY MERCHANTS CARRY SAMPLES.

J. A. Fay & Egan Co.,	94 South Canal Street, Chicago.
Strong, Carlisle & Turney Co.,	193 Bank Street, Cleveland.
E. A. Kinsey & Co.,	127 West 4th Street, Cincinnati.
Thos. K. Carey & Bros. Co.,	26 Light Street, Baltimore.
J. J. McCabe,	14 Day Street, New York City.
Schuchardt & Schutte,	Berlin, C., Germany.



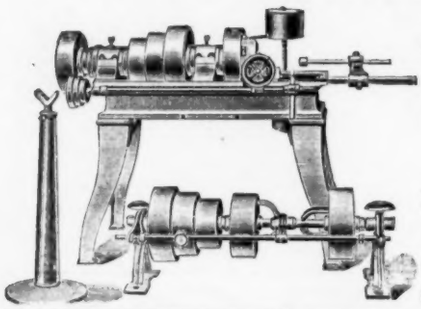
"Every machine running in your works is a monument to your intelligence or ignorance—a money maker or a money eater.

The Flat Turret Lathe will do nearly all of your lathe work under 2 inches in diameter and less than 24 inches long. It will save $1,000 to $1,500 over lathe work, and $400 to $600 over any other turret machine. Sold on guarantees. Our own representatives will call on request. "Rapid Lathe Work" sent free.

▲ ▲ ▲

IONES & LAMSON MACHINE CO.
Springfield, Vt.

THE W. P. DAVIS MACHINE CO.



Builders of Fine

ENGINE LATHES,
From 12 to 30 inch swing.

UPRIGHT DRILLS,
From 10 inch Sensitive to 36 in., with B. G. and P. F.

ALSO

KEYSEATING and CUTTING-OFF MACHINES.

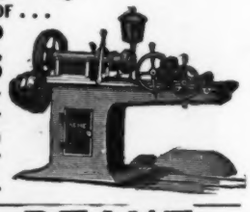
ROCHESTER, N. Y., U. S. A.

Send for Circulars and Photographs.

THE ACME Machinery Co.

CLEVELAND, O.

MANUFACTURERS OF . . .
ACME BOLT AND RIVET HEADERS,
ACME SINGLE AND DOUBLE AUTOMATIC BOLT CUTTERS, cutting from 1-8 in. to 6 in. diam.
ALSO SEPARATE HEADS AND DIES.



William Sellers & Co. Incorp. PHILADELPHIA.

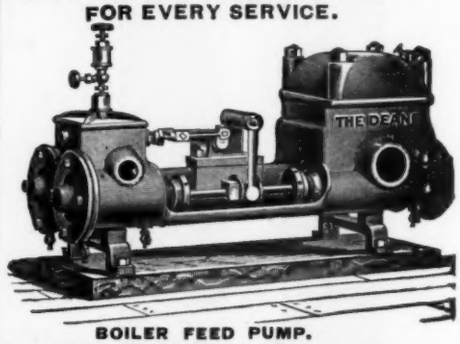
HAVE YOU EXAMINED ?

THE NEW TOOL GRINDER No. 2 ?
THE CENTRIFUGAL SAND MIXER ?
THE VICARS' MECHANICAL STOKER ?
THE NEW RESTARTING INJECTOR ?

These may be seen in operation at our establishment.
Descriptive Circulars Mailed on Application.

THE DEANE OF HOLYOKE STEAM PUMPS

FOR EVERY SERVICE.



BOILER FEED PUMP.

DEANE STEAM PUMP CO.,
HOLYOKE, MASS.
NEW YORK. BOSTON. CHICAGO.

CAN YOU NOT USE ONE OF THESE

Hand Milling Machines

IN YOUR BUSINESS ?

Write us for Photo and Prices of this and our other

MILLING MACHINES,
SCREW MACHINES,
CUTTER & DIE GRINDERS,
HAND LATHES,
TAPPING MACHINES,
SP'NG COILING MACHINES,
PROFILERS,
GEAR CUTTERS,

AND METAL WORKING MACHINERY
OF EVERY KIND.

A Large Stock of New and Second-hand Machinery always on Hand.

ILLUSTRATED CATALOGUE, LISTS AND PRICES FURNISHED ON APPLICATION.

IMPROVED
No. 2 HAND MILLER.

The Garvin Machine Co.

Spring and Varick Sts., NEW YORK,
AND
51 North Seventh Street, PHILADELPHIA, PA.

AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

▲ ▲ ▲

NEW YORK, THURSDAY, AUGUST 13, 1896.

VOLUME 19. ▲ ▲ ▲ NUMBER 33.

Finishing Large Connecting Rods—De La Vergne Shops.

BY JOHN RANDOL.

When the length of a connecting rod is more than, say, six or seven feet, it begins to be an awkward piece in the shop for everything except the plain lathe work. It is always easy enough to turn a rod if there is a lathe in the shop long enough to take it between centers, or long enough to take one end on the head stock center and have more than half the length of the rod over the lathe shears and within the travel of the carriage and tool post; the back rest can be placed at the extreme end of the lathe shears, or "gantry," as the bold Briton has it, and the rod can run in the back rest and on the line center, and the rest of it can hang over in the air beyond the end of the lathe bed while one half of the rod is turned, and then be changed end for end to finish the rest of it. This is pretty awkward, though I have seen it done where a little shop built an engine a great deal larger than it had any business to touch; where there was no planer long enough to plane the rod ends, either, and the "stub-ends" were planed up short and afterwards welded up, and "looked" straight by the boss smith with the aid of a couple of two-foot carpenter's squares hung on the planed ends to "look" them out of wind, and a long pine straight-edge furnished by the pattern-maker to bring the planed ends fair with each other lengthwise. With these old-time remembrances comes also a very distinct vision of a big cylinder on end in the foundry yard, with a spider clamped to each flange and a vertical boring bar journaled in the spiders, and a long wooden sweep clamped to the top of the boring bar, and a very cold "cub" perched up aloft on the end of the boring bar to give the boring-head feed screw a quarter turn every time the helpers tramped once around their circus ring with the out end of the sweep. I was the "cub" in that December cylinder-boring, and the prairie winds blew cold—cold indeed—as I shivered on top of that slowly revolving boring bar for two long weeks. Yet they were not such bad old days—not much tools nor much pay—but we all knew each other and worked hard together and took pride in our work, and it was good work, too, if we did have to do some of it ourselves instead of having machine tools to make every cut, big or little, and cranes and hoists and crabs and special fixtures and blueprints and

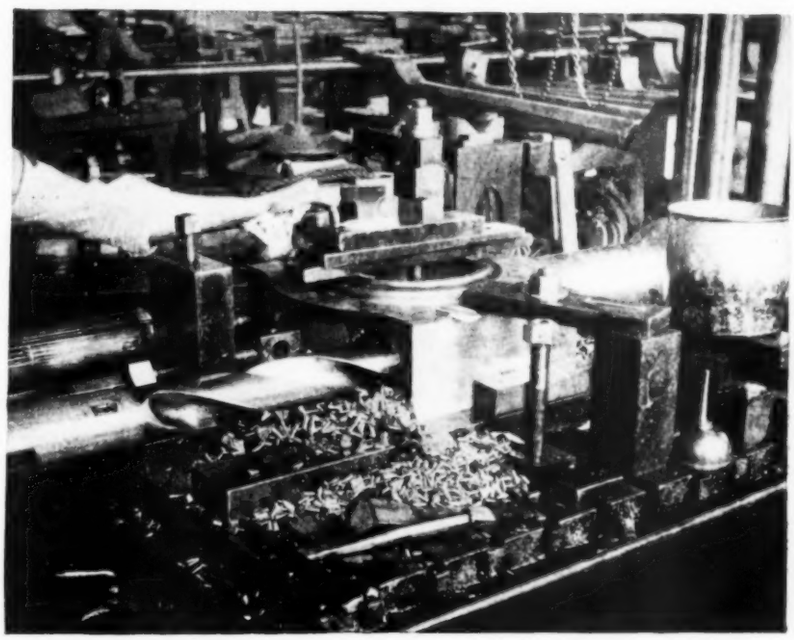


Fig. 1. NEWTON ROD BOX DRILLER—DE LA VERGNE SHOPS.

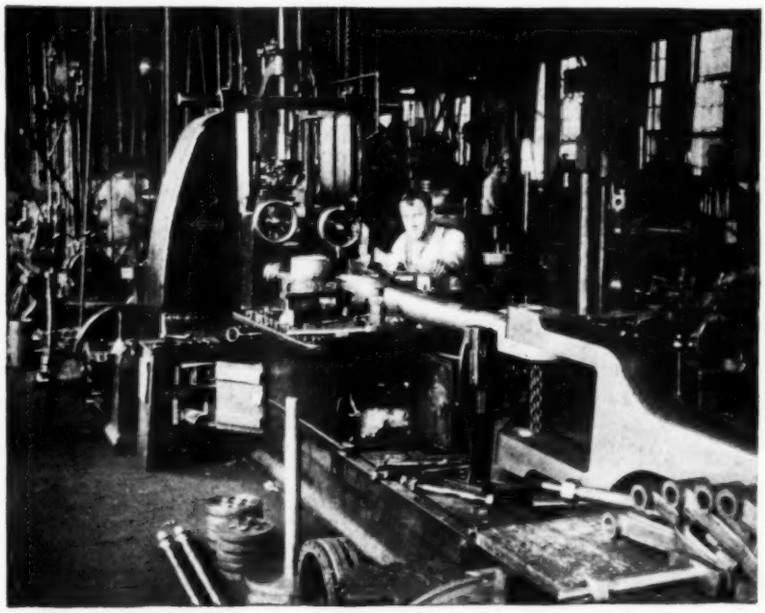


Fig. 2. NEWTON ROD DRILLER—DE LA VERGNE SHOPS.

warm shops, and all the aids and appliances which we then heard mentioned as fairy tales of far-away wonders, when the English hand and the Scotch hand told us around the stove in the noon-hour how things were done at Whitworth's and Nasmyth's and "on the Clyde." Things are different now, and the De La Vergne shops don't plane stub-ends and piece them up into rods afterwards; in fact, they don't even forge them or have them forged in America. The big rod, which is shown in the picture in process of finish-filing, bears the stamp of Fred Krupp, and was pounded into shape in Germany.

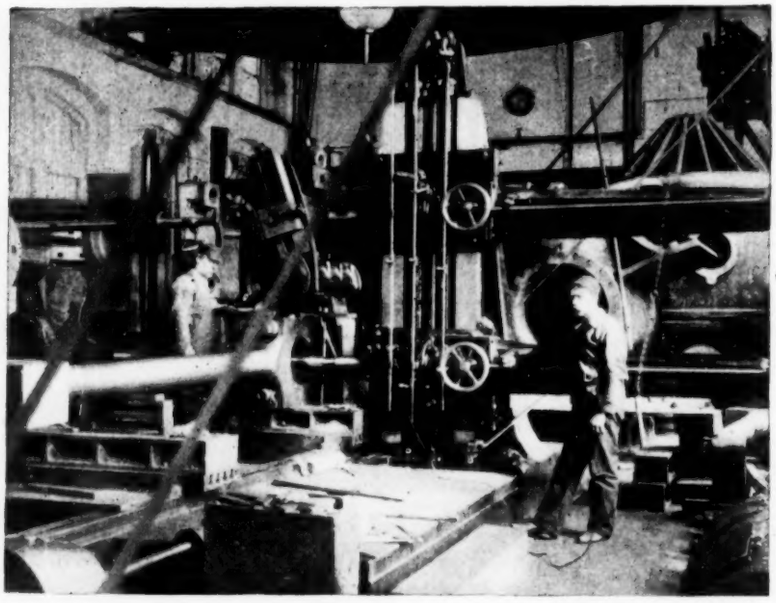


Fig. 3. BORING RODS ON NILES CYLINDER BORING MACHINE.

What I began to say was that a rod of much length might go through the lathe and planer well enough, so far as length is concerned; but when it comes to drilling and boring, trouble begins, and trouble enough, too, to make it well worth while to push things along with the aid of special tools which cost a good deal of money. If the boring is all crosswise of the rod, as is the case when the rod-end boxes or "brasses" are held by a strap and the strap is held with gib and key, or gib and key and bolts, then the drilling is all right too; one end of the rod can lie on the driller table, and the other end can be supported on blocks piled on the floor. But if the rod end is of what we call the "English" pattern, where the end of the rod is a plain T, with the boxes secured by large well-fitted bolts, axially parallel to the rod, then the job takes another complexion altogether, and becomes extremely difficult, because the box bolts should be perfectly parallel to each other when seated in the finished rod; indeed, they must be parallel if the boxes are to be removed without previously driving out at least one of the bolts, because if the bolts are not parallel, the boxes will not slide on them, and hence cannot be taken off while both bolts are in place.

Rods of this kind are also put up sometimes with studs tapped into the T-end of the rod, and in this case the studs are difficult to remove, and, in point of fact, never should be removed under any circumstances. Because of all this, it is needful that the box bolt holes of an "English" rod should be precisely parallel, and the easiest way to bore them parallel is to bolt them down on a table and bore them with a horizontal spindle, as shown in Fig. 1. The quickest way is to have two horizontal spindles, so that both holes can be in progress at the same time, as shown in Fig. 2, a view of the Newton rod driller at the De La Vergne shops, Port Morris, N. Y. This machine has a heavy bed, T-shaped plan, with the work table on one member of the T-bed, and two adjustable uprights dovetailed on the T-crossbar of the bed plan. The drill spindles are adjustable vertically on the uprights, and the uprights are adjustable across the machine, so the spindles can be set any distance apart, and any distance above the work-table within the range of the adjustments. The boxes are first finished on the face plate of the lathe, or on the planer, and then the job is bolted down to the work-table all clamped in correct position, and started by putting drills ⅛ inch smaller than the finished hole size into the spindles, which are set the right distance apart. These small drills are run in a couple of inches or so, and then taken out and the holes are bored up to drill size with a single-point short boring tool, fitted in the end of a stock which goes into the drill spindle socket. This single-point tool, of course, bores the hole exactly true

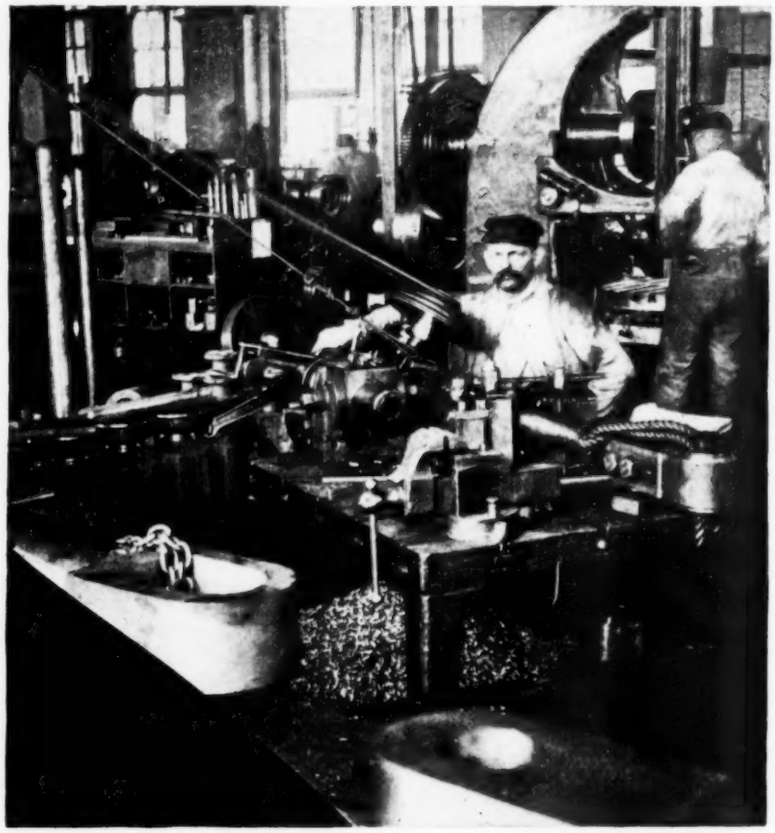


Fig. 4. DRILLING RODS WITH DALLET PORTABLE.

with the spindle axis, and corrects whatever error the rough-drilled hole may have. As soon as one short hole is trued for, say, half or three-quarters of an inch, the boring tool is taken out, and the full-size drill put in its place and started to boring the full-size hole, the trued bore acting as a jig. And it may profitably be mentioned here that there is no other way known so certain to correctly locate a hole as this method of rough-boring and truing with a single-point boring tool. No jig or guide of any form has ever been devised which will guide a drill at the start so efficiently as to certainly locate a hole in a specified position. A drill 1½-inch diameter may be started through a well-fitted bushing, and yet not be located within $\frac{1}{64}$ inch of where it belongs, and this faulty start is very likely to lead to a faulty drill direction, so that the hole is not bored anywhere near on line with the drill spindle axis. But if the hole is rough-drilled, and then bored to fit with a sharp single-point tool put a little way in, then there is a guide for the full-sized drill which is surely in line with the drill spindle axis. The only correct practice in either large or small work is to rough-drill, bore either a little way in or clear through with a single-point tool, and then ream. If jigs are to be depended upon, work must be gaged very frequently, or trouble is sure to follow.

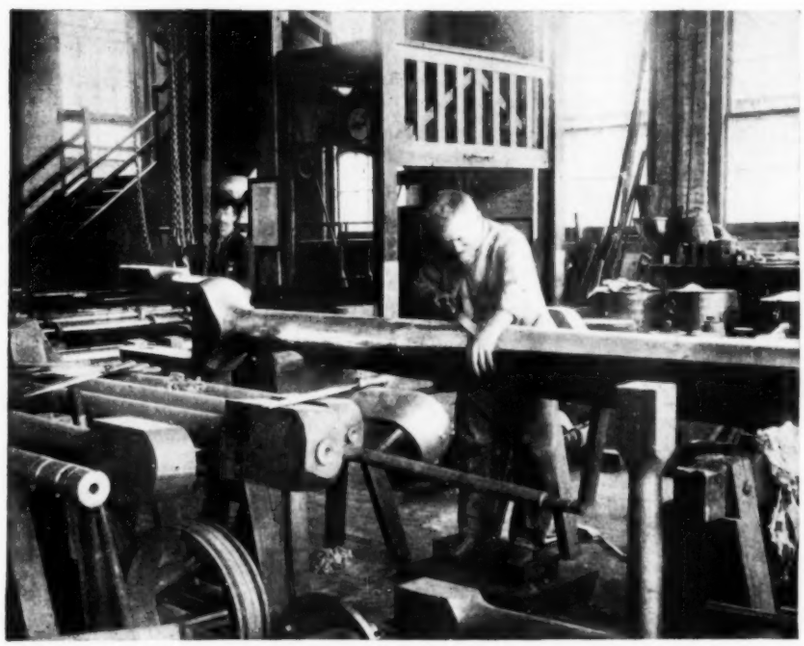


Fig. 5. FINISH WITH CHALK AND FILE.

As soon as one full-size drill is started at work (see Fig. 1) the boring tool is started in the second hole, and in a few minutes both the full-size drills may be at work if desired. It is often the case, however, that the curve of the box cap end has to be counterbored to make the nut seat; in this case, or in case there are not two drills at hand the same size, the big drill may be put clear through one hole, and then transferred to the other spindle to drill the other hole, the workman counterboring and reaming the first hole while the second hole is being drilled.

By use of this machine the drilling of the "English" end rod is very well and easily and quickly done. The two spindles are wholly independent in drive and feed; the feed variation is through cones of spur gears with worm reduction, and the whole machine is well designed, massive, convenient and in every way a good, satisfactory and economical tool. It must have cost a good price, but it far more than pays its way.

The De La Vergne rods are of several different styles. Formerly it was the practice of this shop to make the regular T-rod end, and bolt two half boxes on it; the practice now is, in all cases of new designs, to make one half of the box solid with the rod body, and bolt the other half on in the form of a rebated cap, a bushing being introduced to take the actual wear, so that renewals may be made at as little cost as possible.

After the cap is drilled on and the counterboring is done and the cap bolts are fitted and in place, the next operation is to bore the seat for the brasses, bush, or split sleeve, or whatever may be put into the rod-eye finally to take the wear. There is no tool made regularly which is right for this job. What is wanted is a long table having a vertical adjustment on which the rod can be secured, and a horizontal boring spindle with a vertical adjustment and a horizontal feed action, so that the boring bar can be adjusted to the axial height of the rod, and the eye bored at exactly right angles to the rod axis. Hence, because there is no tool regularly made for boring connecting-rod eyes, it is quite common to see them bored under the upright drill, the rod being carefully trammed to position. The large Niles 3-spindle cylinder-boring machine has the horizontal table, and the lower valve seat boring bar is horizontal and has a feed action and is vertically adjustable, and the photograph reproduced in Fig. 3 shows how this huge machine is used at the De La Vergne shops to bore the eye of a big rod.

For the bolt holes and small drilling of connecting rods, the De La Vergne shops use a Dallet portable bolted to the top of a 4-leg cast-iron table, having a finished top with cross T-slots, shown in Fig. 4. This table top is perhaps 6 feet by 4 feet or so in size, and with a vise bolted to one corner, and the Dallet portable at the opposite corner, it makes the handiest rig I have ever seen for boring a lot of holes which are awkward jobs in any ordinary machine tool, because the work is too long to be accurately placed with convenience and certainty. This drilling table is in constant use on general work; it takes up but little room, and greatly helps in the execution of a difficult class of drilling. There is no engine shop which could not use this simple table and portable drill to good advantage.

Fig. 5—the chalked rod surface, the smooth file and the man—shows the only really universal metal worker ever devised, and one which in these days of automatic tools, when every cut must have a machine of its own for producing it, seems in danger of being entirely forgotten. "Nothing so expensive as vise work and hand-filing," the superintendents say, and say truly, too, probably, and the hand-file goes day by day out of use, being replaced by the mill, the broach and the grinding wheel. It will never go quite away, and the flat filer and the smooth filer, like "Old Charley" in Fig. 5, will remain in the shops, but there will only be one of him where there were a hundred under the machine shop practice of other days when there were chippers and filers, and machinists were general mechanics instead of special machine tenders.

▲ ▲ ▲

The Calumet & Hecla Mining Co. is reported to have recently sold 20,000 tons of old machinery for scrap. The constant replacement of equipment in mines is an item of expense which is only appreciated by those familiar with it, and the Calumet & Hecla, as one of the largest mines in the world, and with its well-known policy in this respect, has ordinarily an amount of discarded machinery on hand which is appalling. The "Black Hills" portion of the mine was opened hurriedly in consequence of the fire of some years ago in the Calumet end, and was equipped temporarily from the scrap heap. This temporary equipment made a better show as an outfit than could be seen at most of the other mines in that section.

The Everlasting Mandrel Question —Expanding Boring Tools.

BY C. O. GRIFFIN.

One of the things which we have always with us is the mandrel question. There are some cases in which it can be best solved by following "Punch's" famous advice to those about to be married—"Don't."

Figs. 1 and 2 show a method which I have followed in several cases with excellent results. These tools were designed for the production of a piece which required to be bored and faced on one end, the boring and facing being required to be true with each other, and at the same time the bore was required to be maintained of constant size in the various pieces. To have done the boring with a common boring head would have involved that the bore would have followed the core to a certain extent, with the further proviso that the facing would have had to be done on a mandrel, with all the loss of time and unsatisfactory results of that method. Both operations could have been done satisfactorily at the same setting by using a lathe boring tool, but that, again, would have been slow, both in the actual cutting and in the loss of time involved in calipering each bore.

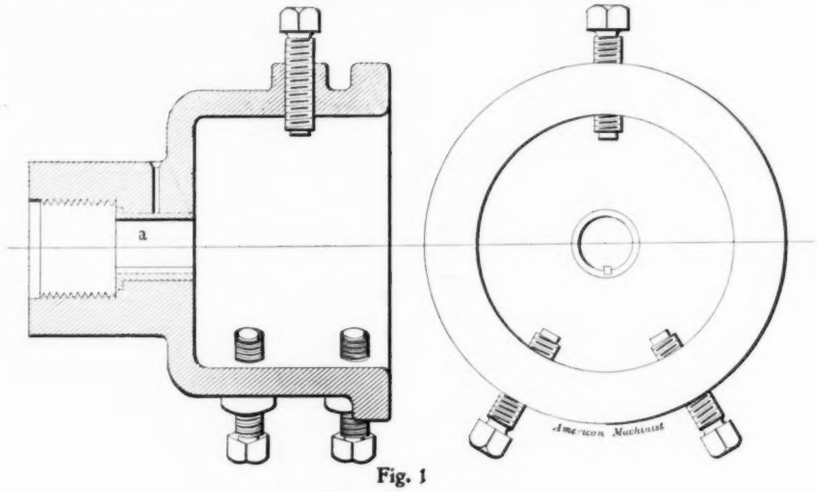


Fig. 1

BELL CHUCK WITH GUIDING BUSH.

I had a turret lathe at hand, and in selecting this lathe I had these jobs in mind, and bought one having a hole through the spindle that amounted to something—namely, 1½ inches in diameter. This hole I utilized in the manner shown. A bell chuck was made as shown in Fig. 1. The four set screws at the bottom form a cradle for receiving and, after being once set, locating the work. A fifth set screw at the top binds the work in the chuck. The novelty of this chuck lies in the hardened steel bush *a*, inserted in the hub in line with the lathe spindle. This bush has a flange next the end of the spindle which retains it in place, the bush being made a running fit in the chuck. An oil hole provides for lubrication. The boring head used is shown in Fig. 2. It will be seen to have an extension which fits the bore of the bush; also a keyway which, by engaging the key in the bush, compels the latter to stand still while the chuck revolves around it, thus bringing the movement at the lubricated joint. To insure the key entering the keyway, a single turn of screw thread is cut at the end of the extension, as shown in elevation at *C*. The tool is carried in the turret, which is fed forward with the lathe in motion. The bush revolves with the chuck until the key engages the side of the slot, which it does with certainty in consequence of the screw thread described, when the bush stops revolving and the extension enters it. The bar is now firmly supported at both ends, and the tools may be fed to the work without danger of their following the core, the extension going down the hole in the lathe spindle. A roughing and a finishing head are, of course, used, and the hole being finished true with the center line of the lathe, the facing may then be done at the same setting with the certainty that it will be true with the bore.

Another feature of this boring head is the method of maintaining its size. Two tools are put through it, which, passing at the center of the head, are held in position by the cone end of the piece *a*, which, entering between them and being backed up by the screw *b*, forces the tools apart and holds them solidly. When the tools become dull, the screw is loosened and the tools are drawn out and secured again. The bar is then taken to a grinding lathe and the cutting points are ground down to the original size, after which they are backed off and the head is ready to bore a new lot of holes to the original size. For a gage for this purpose on all sizes of such tools and many other kinds as well, I use one of Professor Sweet's measuring machines, which I consider one of the best and certainly the cheapest method of introducing standard sizes in a shop. The machine is set to the size desired, whatever that may be, and is then used as a caliper in grinding. It will be understood, of course, that a cup center is placed over the end of the extension and the head of the screw, and, by maintaining the center line, insures that the two tools shall do equal duty.

This system of tools is very useful. In the case shown, the tools were put through the head at an angle because the hole to be bored reached nearly to the bottom of the chuck. Another head which was used on a job which did not require the front guiding feature of the bar is shown in Fig. 3. It is obvious that with such tools, uniform sizes can be maintained indefinitely.

Still another application of the principle is shown in Fig. 4, which represents a tool for counterboring a small cylinder, of which I had a good many to make. The main bore was finished to size by a reamer having inserted blades, these blades lying in grooves with taper bottoms and being brought to size by grinding in the manner already described. The counterbore was required to be of uniform size and to go to a defined depth, which latter precluded the use of a reamer of the style used for the main bore.

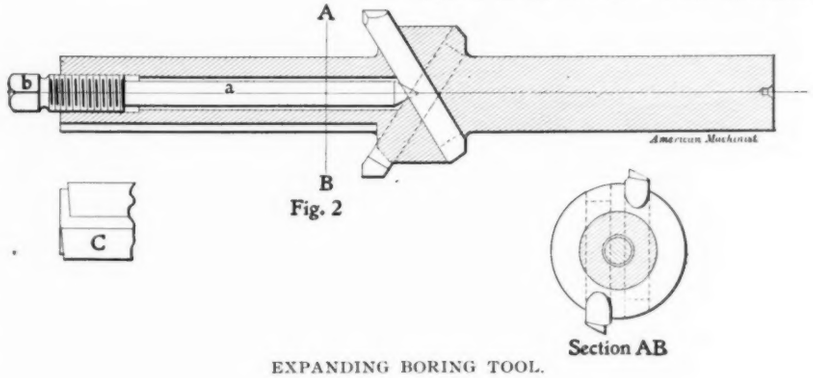


Fig. 2

EXPANDING BORING TOOL.

In Fig. 4 the left-hand end is hardened and ground to the size of the main bore. Two tools are put through the smaller end at a sufficient distance from the shoulder to provide room for the chips, and are held in position by the key *a*. When dull, they are drawn out and then ground to size, as already described, a

pair of plug centers being used in this case to keep the tools in proper adjustment with the center line. These cylinders are required to be counterbored at both ends, and the operation is done in the lathe at the same setting and after the bore is reamed. The counterboring head is first inserted in the right-hand end of the piece. A driving bar, driven by the

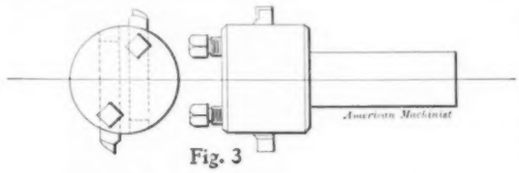


Fig. 3

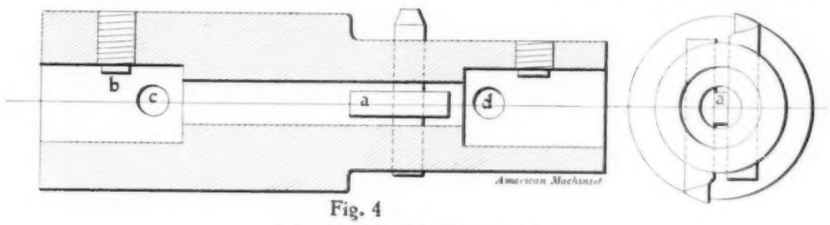


Fig. 4

EXPANDING BORING TOOLS.

lathe, drives the head by the key *b*. At the same time a loose-fitting pin is put through the hole *c* to accomplish the feed, the boring head being drawn into the hole. For the left-hand end of the job the boring head is reversed and is driven in the same way, the driving bar being put in the small end and the head being pushed into the hole by a pin in hole *d*.

In all these appliances the cutting tools are made of simple pieces of round tool steel. These are broken off the bar, hardened and ground to shape, and that is the end of it. The holes through the heads are clearance size and no fitting whatever is involved in making the tools.

▲ ▲ ▲

Tensile Strength of Screw Threads.

Some interesting tests of the strength of various forms of screw threads were made some time ago at the Royal Testing Laboratory at Charlottenberg, Germany, the results of which are somewhat at variance to the common beliefs of mechanics. Four styles of thread were tried, as shown in the accompanying figure, mild steel of two different grades being used. The bolts were tested by direct pull, and also by screwing up the nuts until rupture occurred. For comparison, bars of the same material unthreaded were tested, and also bars with circular grooves of the same shape and bottom diameter as the various threads.

The following conclusions are drawn from the tests:

1st. When subjected to plain tension, both the screw threads and the grooved sections were stronger than the plain bars of the same area of cross-section by about 14 per cent.

2d. No very marked difference in the strength of the different styles of thread appeared, the perfectly sharp groove, Fig. 1, being slightly stronger than the others.

3d. The weakening effect of the turning of the nut under stress was in the 1-inch bolts 20 per cent., and in the ½-inch bolts 15 per cent.

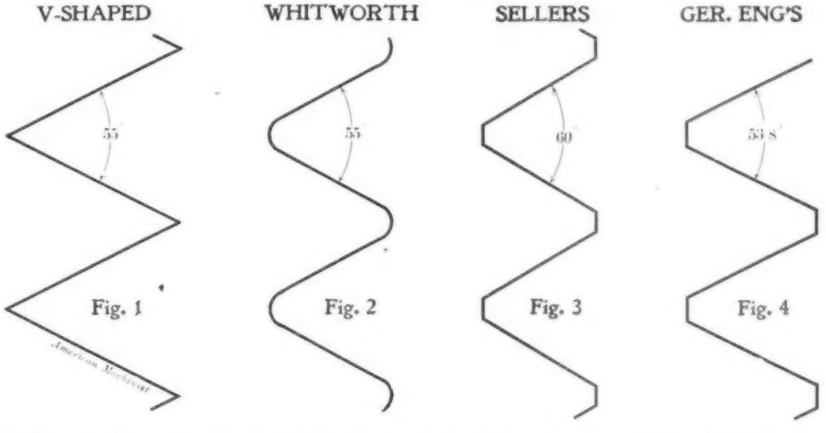
4th. In general it may be said that the turning of the nut upon the bolt at rupture reduces the strength of the net section 30 per cent.

Under fatigue tests by repeated stresses, it is probable that the four forms of screw-threads would show different results. It would be very hard to believe that No. 2 would not be safer than No. 1.

▲ ▲ ▲

Trial of Compressed-Air Car Motors.

The Hardie compressed-air car motor is now being tried in this city, upon a branch of the Third Avenue system. It is too early to speak of the practical success



of the car. It runs well and is under easy and perfect control, the air brake stopping the car probably quicker than surface cars have ever been stopped before. The features of the Hardie system are well known. The present cars are provided with long air tanks under the seats, and shorter tanks crosswise under the body of the car. They have a collective capacity of 51 cubic feet, and they are charged to a pressure of 2,000 pounds when starting out. The air passes a pressure reducer which maintains a working pressure of 100 to 150 pounds, this pressure being adjustable. The air then, before used, is passed through a hot-water tank, whereby it is not only heated, but saturated with moisture, the vapor so carried largely augmenting the ultimate efficiency of the charge of air. The Hardie valve motion produces an admirable diagram, and leaves little improvement to be suggested as to the correct expansive use of the air. We hope later to speak more fully of the success of this experiment in which so many are interested.

▲ ▲ ▲

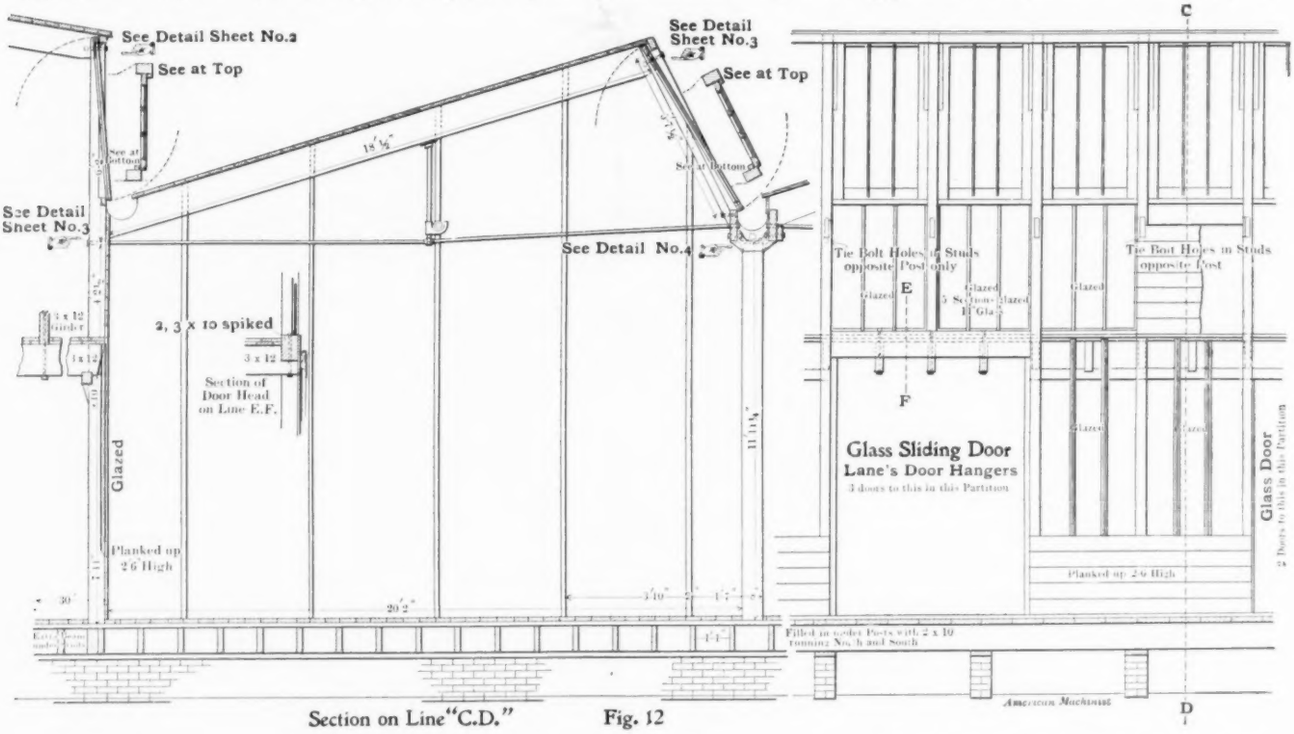
A Manufacturing Machine Shop—III.

After the hemlock floor planks were laid, the 40-foot staff was again brought into use, and the pillar locations on the east and west walls and on each alternate intermediate wall were determined thereby, and the studding for the stores and office building, 30 x 100 feet, located by the rod to the same 40-inch centers. The outer pillars were 8 inches square, and the studs of Georgia pine 6 x 4 inches. The pillars are uniformly 12 feet long. The rafters of the stores building are also spaced 40 inches, so that each one can be fastened to an upright. The second floor of the stores building is supported by notching a 4 x 4-inch ribbon strip of Georgia pine, ½ inch into the studs and ½ inch into itself, and bolting this ribbon strip to the studs; the second-floor beams are notched onto the ribbon strips, thus tying the building crosswise. The first story is the unfinished stock-room, and is made only 8 feet in the clear, so that the shelves in the stock bins can all be reached without a step-ladder. This low ceiling also makes the office floors in the second story easier to reach than if the store-room were high, and, which is also a decided point of advantage, brings the floor of the superintendent's room so low that, sitting in his chair, he can see, under the gutter beams, the whole interior of the machine shop, as is shown in Fig. 3. The stores building was joined to the first bay of the shop by notching the stud for the foot of the rafter, which is secured with a bolt, as shown in detail in Fig. 12. Rafters of stores and office building are 4 x 10 inches, and the roof is 30-foot span, low-pitched; the rafters of all the roofs are covered with 1¼-inch spruce, tongued and grooved, laid with planed side down, and covered with best 3-ply building

paper; the roofing throughout is mica felt of the best quality. The second or office story of the stores building is 10 feet in the clear; the office floor is first a diagonal course of 1¼-inch spruce, tongued and grooved, then covered with building paper, and on top of that, 1 inch of yellow pine, tongued and grooved, is laid east and west. Ceilings, partitions and doors are of Georgia pine.

The one real problem of the saw-tooth roof in this climate is to take care of a heavy snow-fall, and the freezing and thawing of water in the long roof gutters, and the moisture which precipitates on the metal roof gutter on the under side and drips down on the shop floor below unless disposed of in some more agreeable manner.

The general cross-section construction of the bays is shown in Fig. 12, and Fig. 13 gives an enlarged construction of the pillar cap and gutter beams and gutters. By the floor slope, with gutter beam supporting posts all 12 feet long, the wrought-iron gutter troughs, ⅛ inch thick by 12 inches wide by 8 inches total depth, have, as they lie with their top edges flush with the top edges of the gutter beam, a slope of 1 in 120 each way from the middle, and a steam pipe is carried the whole length close up under each gutter. This arrangement gives, first, a good location for the steam-heating pipes, convenient and yet out of the way; second, it keeps the gutters always warm; and third, any drip from gathered moisture on the underside of the gutters drops on the steam pipe and is vaporized. Commonly, no drip occurs, as the gutters are too warm to precipitate the moisture in the air; but when the gutters do "sweat" and drip, the drip never goes beyond the top of the steam pipe under the gutter. The gutter beams are 12 x 3 inches yellow pine in 20, 30 and 40-foot lengths—as long as could be conveniently had. This length of gutter beam makes it safe to remove any pillar which may be found in the way of the most suitable arrangement of tools on the shop floor. The gutters are screwed to the inside of the gutter beams by ⅜-inch lag screws in slotted holes near the top gutter edge, so that the long riveted iron gutters can expand freely.



Section on Line "C.D." Fig. 12

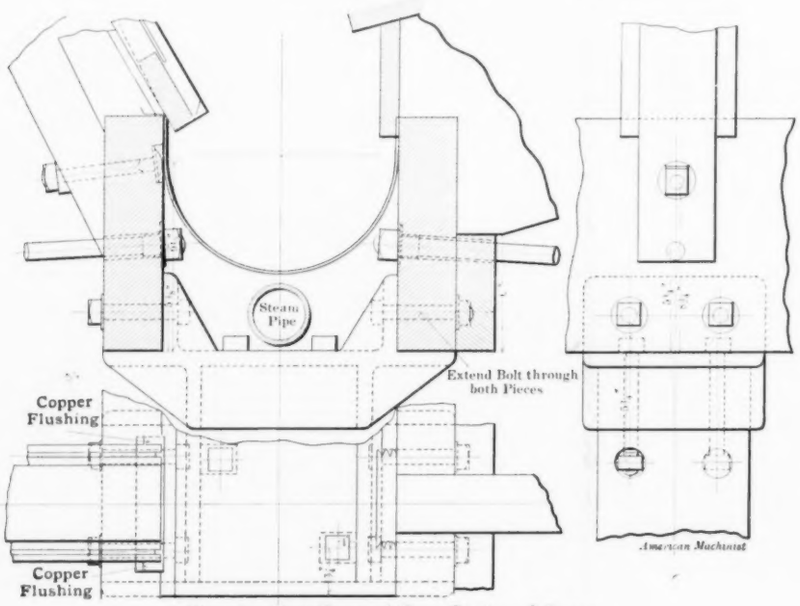


Fig. 13 Post Cap and Cross-Section of Gutter

The roofs support, as a safe load, 4 feet depth of snow (= 4 inches of water). The foot of each 8-inch pillar base is screwed to its solid block of wood filling between the floor timbers by four ¾-inch lag screws, 8 inches long, screwed into ⅜-inch holes bored through the floor into the filling blocks. By use of the 40-foot "gage" staff, the location of any and every timber in the building, no matter how covered, can be readily and surely determined. Not only the steam-heating pipes, but those for gas and water, and air pressure for gas blow-pipes and forge, and furnace uses, and some of the electric current wires, are carried in the spaces between the gutter beams, which makes a very convenient and sightly arrangement.

The lighting is, of course, from the

north face of the saw-tooth roof section, and consists of glazed sashes, as shown in the drawings, pivoted a little above the center, closing on the gutter at the lower edge, and fitted with a rock shaft, links and hand-rope segment, and hand ropes to open the sashes for ventilation. Originally, the sashes of each bay were fitted to open, but it was found that even on the warmest day it was enough to open the sashes of each alternate bay. The ventilation thus afforded is, of course, at the extreme top of the enclosure, and at a point 6 feet below, which is much cooler, being always in the shade while the high line is in the sun; hence a slight but certain air circulation at all times when the sashes are opened. The heating is by steam coils, which are ample to hold any needed temperature.

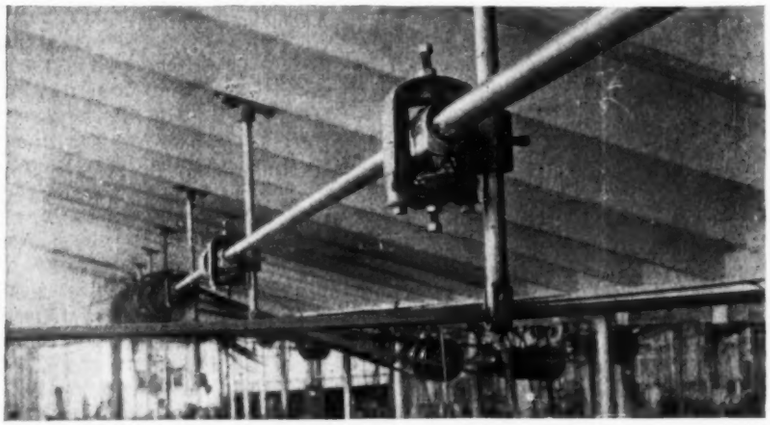


Fig. 14. LINE SHAFT SUPPORTS.

The side walls have one window in the middle of each bay; these windows are not needed at all for light, and are decidedly objectionable from a photographer's point of view. The side-wall studs are 2 x 6 inches, 12 to 18 feet long (reaching into the apex of the saw tooth), and so bolted as to be readily removed without disturbing anything else; on the outside of these studs was nailed horizontally 1¼ inch tongued and grooved pine stuff, then two thicknesses of tarred paper, and outside of this again a second course of the same 1¼-inch stuff was nailed vertically. Thus the whole structure is supported independently of the east and west walls which make the gables of the saw-tooth roof, and these walls can be removed at any time without disturbing anything but themselves, and were so removed when the bays were extended, and again replaced in new positions, without in the slightest degree disturbing the shop operations.

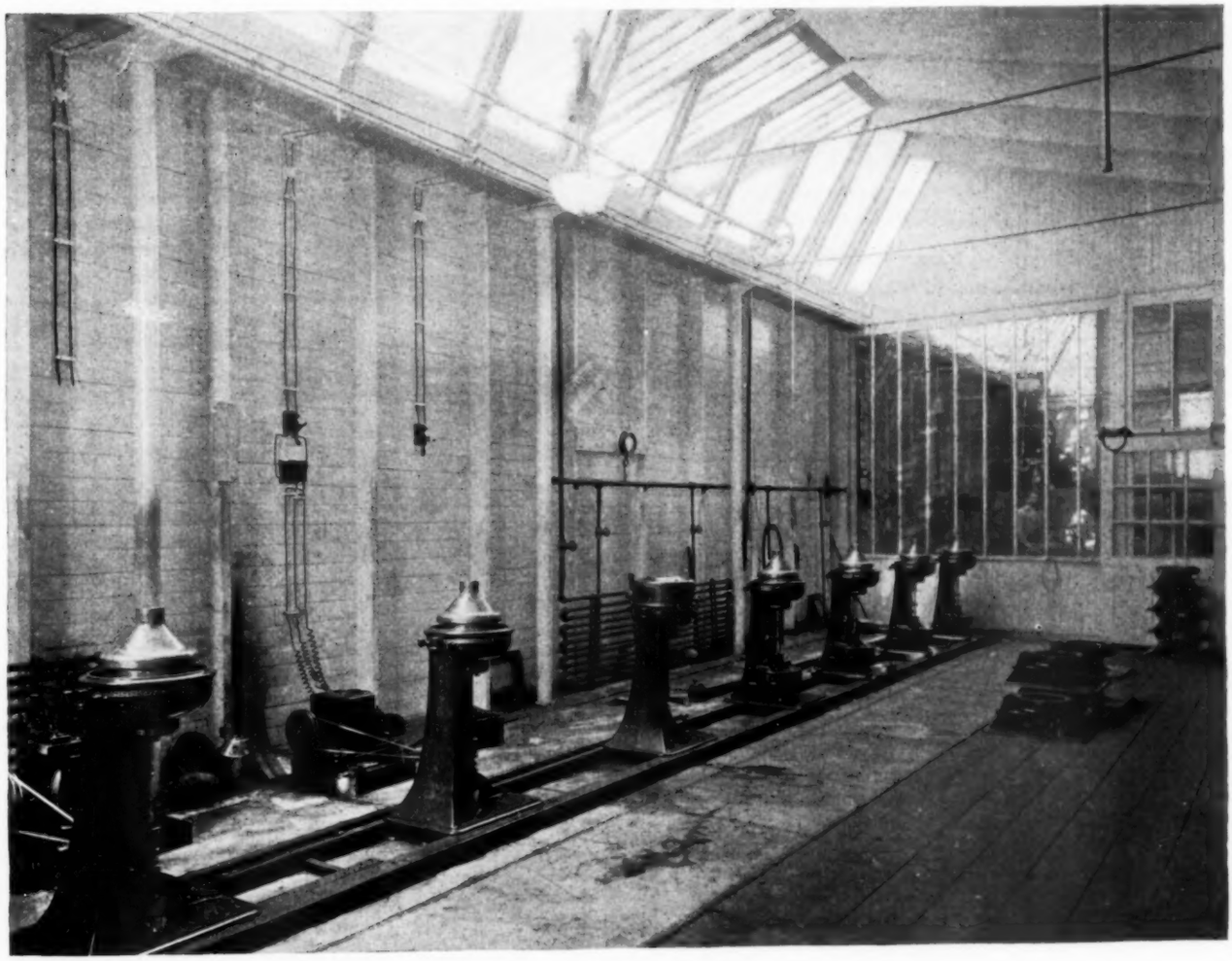


Fig. 15. TESTING FLOOR.

Thus, this shop can be truly said to be capable of extension in three directions while yet retaining a perfect and unvarying system of lighting, driving, heating and ventilation; all within the limits of

vision, open to simultaneous inspection, and built at a cost of less than 75 cents per square foot of floor surface, and every single square foot of floor in the whole place equally and perfectly available for productive use—a statement which can never be truthfully made regarding any side-lighted or multi-flooded shop structure.

The construction drawings, with their descriptive titles, are so intelligible as to require no particular description.

Fig. 15 is a view of the testing floor, and shows the sash-lifting rock shaft, hangers, arms and sash links, and the rocker wheel and hand cord, more plainly than they appear in any of the other engravings. Some of the separators stand on the rails for testing, are power-driven, and are shown connected to motors; others are driven direct by the De Laval "steam turbines," built into their bases, and are, therefore, piped to the steam in the rear for testing.

The stock bins in the unfinished store-room are all of one size, shelved at hights to suit the piece contained in the bin. The rough castings store-room has no racks or shelves, the pieces being of such shape as to pile in compact form.

The superintendent's room, Fig. 3, is on the second floor of the stores building, in the middle, directly over store and time-keeper's office on the first floor, and communicating therewith by a speaking tube. The rafters of the first bay join the stores studs about 50 inches above the superintendent's office floor, and this 50 inches is glazed with clear glass, so that, as he sits at his desk, a glance to the left shows him the entire machine shop floor and every man on it.

The shafting support for the 150-foot line of 2-inch shafting, running the length of each bay in the machine shop, is shown in Fig. 12, and from a photograph in Fig. 14. The side hanger slides on a vertical 1¾-inch rod, supported at the top in an angle shoe screwed to the under side of a rafter, and secured by a clip, bolt and set screw to a tie rod reaching across the width of the bay at the foot. The rafters rise in the middle of the building to correspond with the 1 in 120 slope of the floor each way; hence, there is a variation of

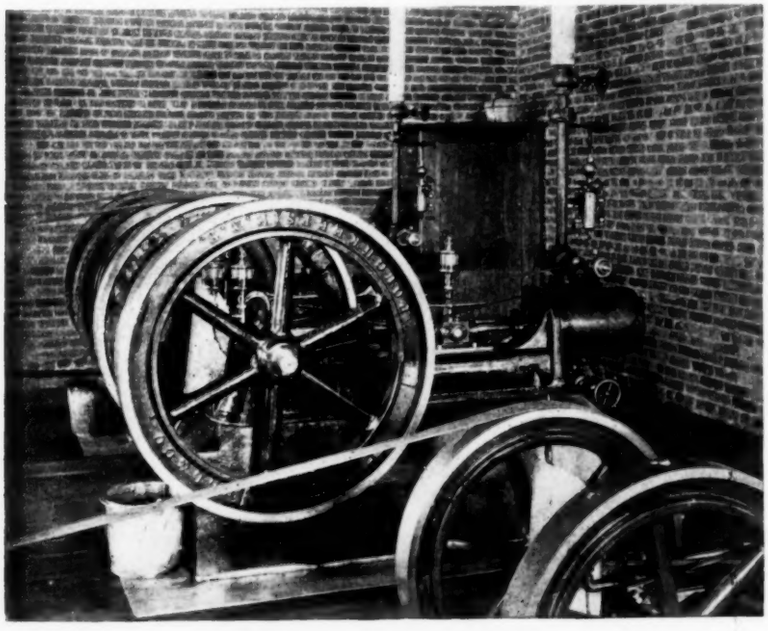


Fig. 16. THE POWER PLANT.

Fig. 17. PLAN OF SHOP

5 inches in hanger journal hights above the tie rods in every 50-foot length of shaft, measured from the middle of the original shop floor. The photograph was taken from next to the most westerly hanger on a line of shafting, and shows the box at almost its extreme hight above the tie rod. This arrangement gives a line of shafting to every 20 feet of floor width in the middle between the as are the testing-floor lines of shafting, Fig. 15. There is also one motor mounted on a truck, which can be handled easily by one man, and can be used for any experimental or unusual drive about the place, as shown near the middle of Fig. 8.

Electric driving was more of an experiment in 1892 than it now is, though it is yet among the things that are to be, so far as general machine shop use is concerned, and the original drive of the shop was from one of the little 7 x 10-inch plain slide-valve engines shown in the photograph of the power house interior, Fig. 16, which was belted direct to the first line of shafting, from which the second was driven, and so on up to the south bay line. But for the shafting in bay No. 5, a Church, Ward & Perry generator was installed, with such satisfactory results as to lead to a contract with the C. & P. Co. for six 5 horse-power motors and one 30 kilowatts generator; also a 30 kilowatts Jenney generator and three Jenney motors—one 7, one 3 and one ¾ horse-power; also four C. & P. 2 horse-power motors, and six C. & P. 1 horse-power motors. The smaller motors are used for various independent drives about the place.

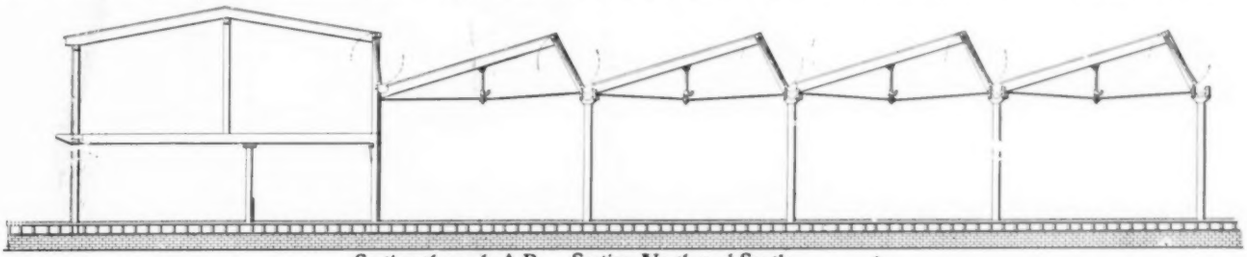


Fig. 18 South Elevation

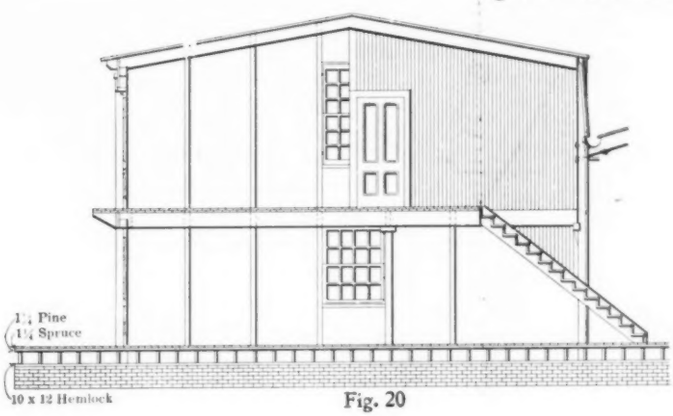


Fig. 20

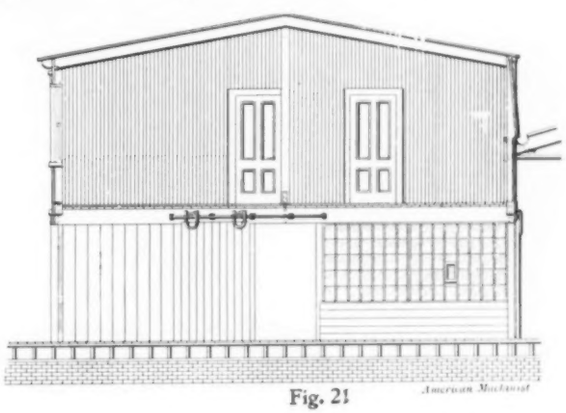


Fig. 21

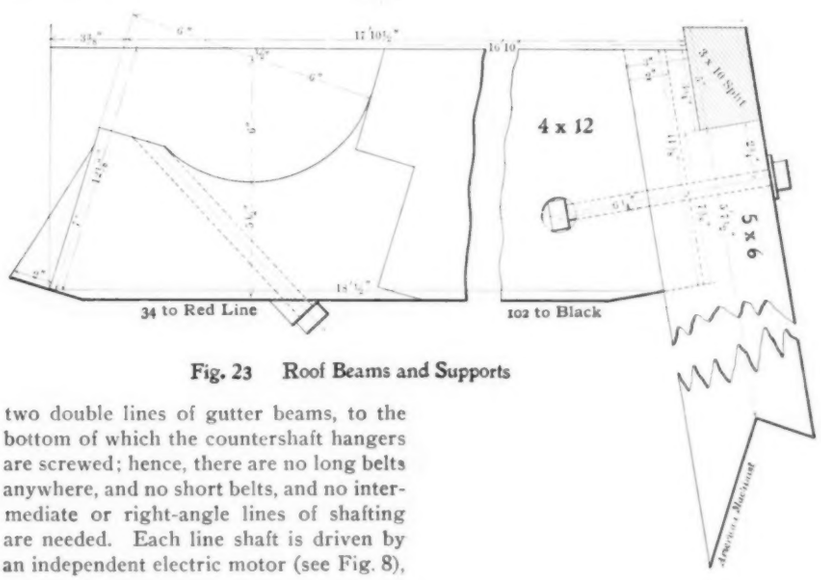


Fig. 23 Roof Beams and Supports

two double lines of gutter beams, to the bottom of which the countershaft hangers are screwed; hence, there are no long belts anywhere, and no short belts, and no intermediate or right-angle lines of shafting are needed. Each line shaft is driven by an independent electric motor (see Fig. 8),

The shop is night-lighted throughout by forty-six arc lights, so under-shaded that there are no shadows, and at night the whole place is made as light as day. The inside walls and roof of the shops are painted with asbestos paint throughout, and all the light from the arc lamps is thrown upward to the roof from underneath reflectors, and then diffused from the white roof surface to the floor below.

A Shaper as a Milling Machine—A Job of Internal Milling—An Interesting Molding Machine.

You know, Mr. Editor, that it is quite the fashion, especially amongst us older craftsmen, to think and to say that the jobbing shop where your Simon pure machinist holds forth is the place where thinking is done, where there is opportunity to exercise originality and a chance to learn things. Anybody, we say, can do good work where there are plenty of tools and appliances for everything; but where there are no tools to speak of, and where jobs must be done satisfactorily without them, it is different, and in such places is where thinking must prevail.

I am going to describe here three jobs wherein thinking was evidently done by somebody. These jobs were all done in shops where they have plenty of tools, and, besides teaching other lessons, they illustrate the fact that he who has thinking faculties and is in the habit of using them can find plenty of chances to confirm that habit in almost any kind of a shop; even in a foundry.

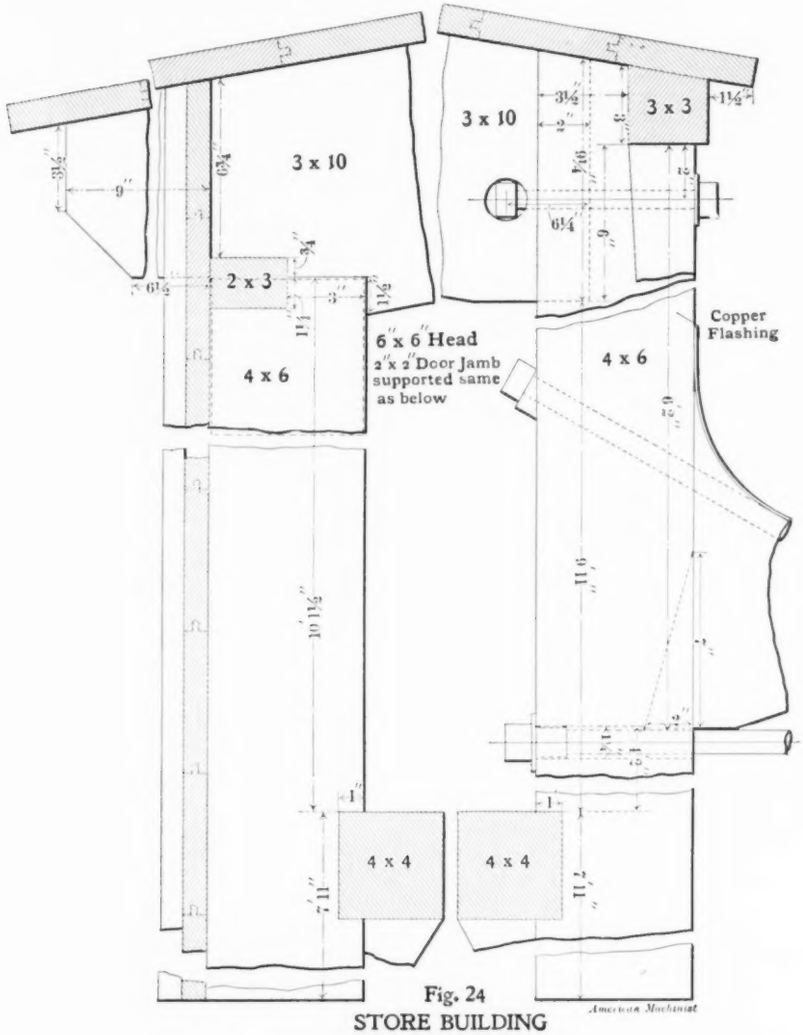


Fig. 24
STORE BUILDING
North and South Studs

MILLING ON A SHAPER.

When I mention milling on a shaper you immediately imagine a milling arbor mounted upon the end of the ram, means for driving it and special attachments for slow feeding; but there would be nothing specially original about that, whereas this job, as I said before, was original. Nothing was done to the shaper at all; it simply worked along about as usual, taking a stroke about 8 inches long at about the usual speed, and it milled one side of a small steel piece at each stroke. It did a good job, smooth and accurate, and worked automatically—*i. e.*, the pieces were put in place one after the other, milled off smooth and thrown out ready to be taken away—all without attention, and I suppose the work done to make this very ordinary shaper do this very extraordinary thing did not cost over $50 all told.

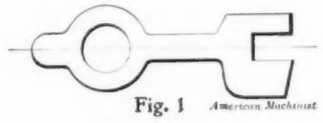


Fig. 1

THE PIECE MILLED.

The approximate form of the piece, finished, is shown at Fig. 1, which is about full size. It is of mild steel about ⅛ inch thick and is punched and trimmed to the shape shown. I do not now remember whether the piece was punched to shape before the milling was done or not, but that is of no importance in any event.

Before being milled the piece is ground true and flat on one side by being held, free hand, against the side of a lapping wheel, and is then ready for the shaper-milling machine, which was rigged up by simply making a few changes in the vise, as shown at Fig. 2, in which figure *a* may be called a vise jaw with teeth which takes the place of the ordinary smooth jaw. The other jaw was plain, hardened and ground smooth and set by the usual screws, so that the distance from its face to that of the toothed jaw was just equal to the thickness of the piece to be milled. The pieces were placed in a box *b*, attached to the rear of the vise and having a helical spring *c* which pushed the pieces constantly forward against the projecting end of the toothed jaw. The tool in the tool post was much like a cutting-off or parting tool—thinner than the pieces to be milled and used, not to cut, but only to push the pieces through between the smooth and the toothed jaws. The boy simply put them in the box so that the ground side of each would be next the smooth jaw, as it was pushed through, shoving the spring back and putting in as many as he could find room for. As soon as the pusher had started a piece in, the spring fed all the remaining pieces forward, thus bringing the next piece into position to be carried through at the next stroke, and the pusher got over and behind the next piece, in position to push, simply by the action of the clapper-box in the usual way.

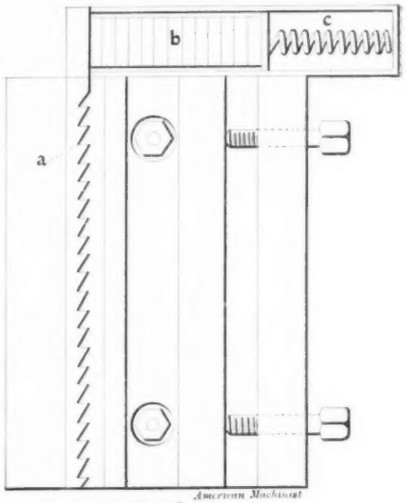


Fig. 2

THE MILLING FIXTURE.

I suppose some mechanics would call

this a broaching job rather than a milling job, and perhaps it is; but, whether broaching or milling, the arrangement was doing the work of a milling machine, and doing it well. The piece is part of the "Fitch" typewriter, which has now been superseded by the "Williams," and I saw the job in the shops of the Brady Manufacturing Co., Brooklyn, where both these machines were developed and for a time manufactured. The sketches are made from memory, but are sufficiently accurate for the present purpose.

Mr. Brady started his mechanical life as a tinsmith, and is not what you and I wou'd call a regularly trained machinist. He therefore does a great number of

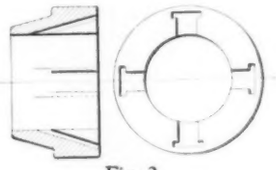


Fig. 3

A JOB OF INTERNAL MILLING.

things that we regularly trained men would not think of doing. Some of these things are really quite shocking to a machinist of refined sensibilities and a nice sense of propriety. But, as I have noticed before in other men similarly trained, he, along with his shocking performances—his doing things in a manner in which you

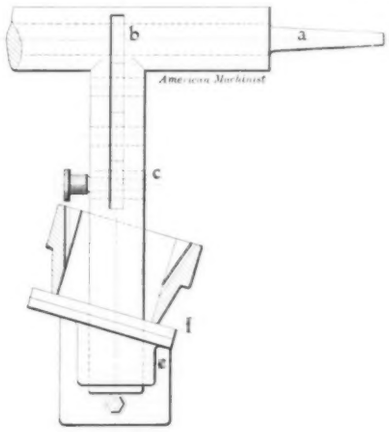


Fig. 4

AN INTERNAL MILLING FIXTURE.

or I, Mr. Editor, could not be induced to do them on any account—exhibits a good many streaks of real genius, and succeeds where we regularly trained men would be at a loss how to proceed, or would perhaps spend much more money for fixtures. The case illustrated is, I think, one such instance. I regard it as nothing less than a stroke of genius, and I often wonder whether these men who have not "stuck to their lasts" would do better things or worse things if they had been regularly brought up in machine shops. They might do some things better, but would probably not do at all many things they now do and that are, to me at least, very interesting.

A JOB OF MILLING.

The next job I am sure is milling. I saw it in the shops of the Acme Machinery Co., of Cleveland, O. As most of us know, the Acme Machinery Co. make bolt cutters, and their Acme head has on it a sliding collar which has in it four T-slots by which the dies are opened and closed; the T-slots being at an angle, as shown at Fig. 3, which is approximately a section and end view of this sliding collar.

There are simpler and easier jobs than milling these slots all at the proper angle and with sufficient accuracy for the job, which is a piece of very nice work throughout. It is accomplished by a simple fixture made to be used with an ordinary milling machine having an overhanging arm, and an idea of its construction may be had from the sketch Fig. 4, in which *a* is the tapered end of a shaft which takes the place of the ordinary cutter arbor. It runs through a shell or sleeve, and at the middle has, keyed to it, a small spur gear wheel *b;* this drives the train of similar wheels and finally the short spindle *c*, which is bored taper to receive the shank of the cutter as shown. The arm *d* which supports this train of gearing is cylindrical and is a sliding fit in the hub cast on the angle plate *e;* and this is an angle plate in a double sense, since its front face is made at the proper angle for the slot and is fitted with the revolving and indexing plate *f* to which the work is attached and indexed around from one slot to another. The angle plate is, of course, fastened to the platen, and the ordinary platen feed is utilized. I do not now recall just how the outer end of the sleeve is supported or held by the overhanging arm, but that may be done in various ways that will readily suggest themselves.

A JOB OF MOLDING.

The third job, and the last one I shall bother you about this time, I saw in the foundry of the Stearns Mfg. Co., at Syracuse, N. Y., and the object of this piece of ingenuity was to make large numbers of small rope sheave wheels, about 10 inches diameter, perhaps, and of a section about as shown at Fig. 5. No arms are in the wheel; it is webbed and smooth. A molding machine had been made for this job, and at Fig. 6 is a sketch that will give an idea of how this very simple molding machine was constructed and how it did its work.

First, a plain cast-iron plate *a* was made, and this plate had a hole cut through it just exactly the size and shape of the section of the wheel. This plate is fastened on top of a box as shown, and across the upper face of the plate is a half-round groove which takes a shaft of corresponding size. Such a shaft is fitted to it, and at one end of this shaft is fastened a crank-handle, to turn it by; while in the middle of the shaft is fastened, by screws, just half of one of the sheave wheels, smoothed up for a pattern. Snap catches are arranged to hold the aforesaid crank-handle in two different positions 180 degrees from each other, and when in one of these positions the half-wheel pattern is above the plate so that its sectioned face just covers the hole in the plate. When in this position half of a flask is put on (over dowel pins that accurately locate it) and sand is filled in and rammed up. Then the crank-handle is given just half a revolution to its other latched position, which turns the pattern down through the sand and

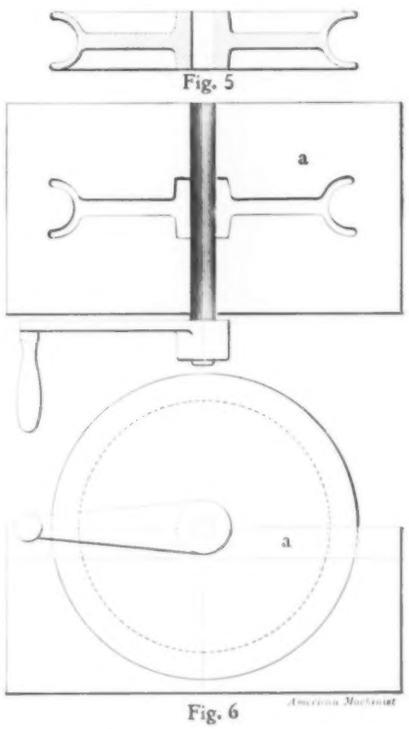


Fig. 5

Fig. 6

A MOLDING MACHINE.

through the plate into the box below; its sectioned surface again filling the hole in the plate as before, only now from below instead of from the top. Twice as many such half flasks are made as there are molds to be put up, and they are used indifferently for drag or cope.

I do not now remember whether there is a core or not, but if there is, the revolving shaft makes a proper print for the core; which print must, of course, be filled in some way in any event.

The sand is "slicked" by the pattern automatically, so to speak, and there isn't even a chance to get at the mold and touch it up here and there with the tools that make lumps on the work. All the molder can do is to squeeze his bellows at it once or twice to blow out the loose sand—which usually isn't there.

This, to me, was a brand new way of drawing a pattern, and it made a beautiful mold.

S. T. FREELAND.

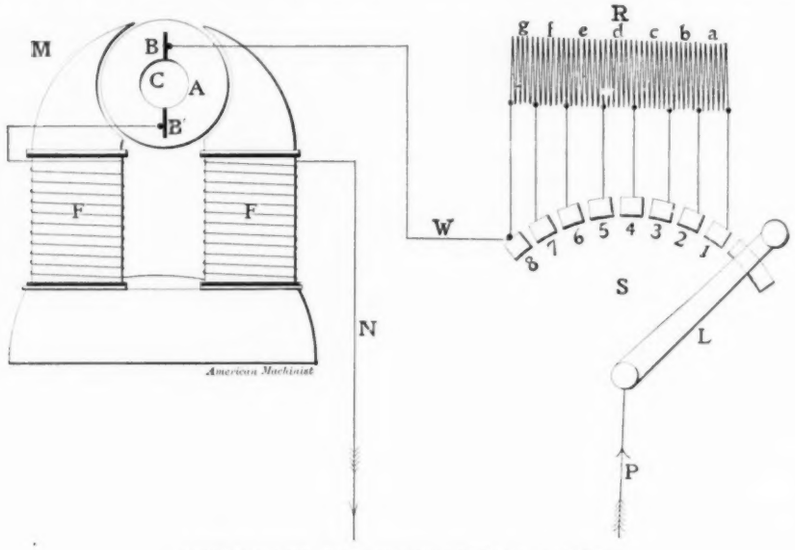
ELECTRICAL MACHINERY.

Controlling Devices for Series-Wound, Constant Potential, Electric Motors.

BY WM. BAXTER, JR.

Every form of prime mover must be provided with a starting device, so arranged that the amount of force applied when it is started may be under the control of the attendant. In the steam engine a small and simple valve is used, the simplicity of construction being rendered possible in this case on account of the nature of the agency through which the impelling force is applied. With water wheels a similar but larger device is used. In both cases the construction of the starting valve is such that the rate of flow through it may be controlled.

With an electric motor a starting switch is used, which acts in substantially the same manner as the starting valve in the case of the steam engine and the water wheel; but owing to the difference in the agency by means of which the force is applied, the devices used to accomplish the result are very different.



CONTROLLER FOR PLAIN SERVICE MOTOR.

In the case of the engine, the flow of steam is regulated by varying the resistance it encounters in passing to the engine, by varying the opening in the starting valve. The starting switch of an electric motor also regulates the flow of current by varying the resistance it encounters in passing to the motor. As electricity is not of the nature of water or steam, we cannot use a valve to regulate the flow, but we accomplish the same result by using what is called a rheostat, or resistance box. This rheostat, in combination with a suitably constructed switch, constitutes the starting switch, or, as it is sometimes called, the starting box.

The principles involved in the construction and operation of the rheostat are practically the same with all types of constant potential motors, but the switch has to be varied to suit the requirements of the different cases. The simplest arrangement of rheostat and switch is that used for the plain series-wound motor. The general arrangement used in such cases is shown in the accompanying diagram, in which *m* is the motor, *R* the rheostat, and *S* the switch.

When the switch lever *L* is moved onto the contact block 1, the current coming from the source from which it is derived through the wire *P* will pass through the entire length of the rheostat *R* to contact 8, and from there will enter the wire *W*, and through the brush *B* and commutator *C* enter the armature *A*, from which it will pass out at the opposite side of the commutator, by the brush B^1, and then pass through the field coils *F* and enter the wire *N*, through which it will return to the source from which *P* came, and thus complete the circuit.

In a steam engine, if the starting valve were thrown wide open instantly, the results would not be serious; but if we were to try to duplicate this action with a motor the results would in all probability be disastrous. This action we could accomplish with the arrangement shown in the diagram, by moving the lever *L* as rapidly as possible over to contact 8, in which case *P* would be placed in direct communication with *W*.

With the steam engine, if the valve were thrown wide open at once, the flow of steam would be checked by the piston, and the amount passing through the valve would be dependent upon the velocity of the piston. With the motor, this condition of things would not hold good. If the current in wire *P* could pass direct to wire *W*, the result would be that the first flow would be very great, as there would be, practically, nothing but the resistance of the wire on the motor to hold it back. As has been explained in articles that have appeared in these columns, when a motor is running, the armature sets up a counter electromotive force which is practically a back pressure, and, in fact, is very commonly called such by English electricians. This back pressure is proportional to the speed; it therefore starts from nothing as the armature begins to turn and increases gradually with the velocity. Before the motor has got under way, the counter electromotive force being small, there would be a heavy rush of current through the motor unless a resistance was interposed, and this heavy current would very likely burn out the armature. If the resistance of the rheostat *R* is made such that it is equivalent to the back pressure set up by the armature when the motor is running at full speed, it follows that if the lever *L* is placed on the contact 1, on starting, the initial current will be about the same as that used at full speed. If the resistance is made greater, the starting current will be less than the full speed current; and if it is made less, the starting current will be greater. If all the rheostat resistance is cut out on the very start—that is, if *L* is moved at once to control 8—the current will be the greatest possible, as nothing but the resistance of the wire on the motor and the reaction of the current upon itself would hold it back. If the resistance of the motor were large in comparison with the counter electromotive force, the initial current, when starting without an external resistance, would not be so very great; but if a motor is efficient its internal resistance will not offset more than from about three to six or seven per cent. of the counter electromotive force. Hence the initial current, if no external resistance were thrown into the circuit, would be from fifteen to forty times as great as that required to give the full power of the motor. Such an enormous rush of current through the motor at the start would not only be almost sure to prove disastrous to the motor itself, but would also create a considerable disturbance in the mains of the circuit from which the current was derived. With a ten horse-power motor, the internal resistance would be about three per cent.; therefore, the starting current would be thirty-three times the normal, or enough to supply a motor of three hundred and thirty horse-power. Such an enormous drain upon the source of supply, coming from a motor ordinarily requiring but ten horse-power would certainly produce serious results.

From the foregoing it will be seen that an electric motor cannot be started without introducing into the circuit a resistance that will keep the current down while the counter electromotive force is

building up. With such a resistance, the motor can be cut in or out of the circuit without injury to itself, and without creating any unusual disturbance in other parts of the circuits.

The rheostat *R* can be made in a great many different ways, and there are a great variety of them on the market, but in every case their action is the same. The changes in design, as well as construction, are wholly for the purpose of improving them mechanically. A good rheostat should be so made that it will withstand a considerable amount of heat without injury, and also of insulating material that is not affected by moisture.

The switch *S* should have a sufficient number of contacts to prevent a noticeably violent increase in speed when the lever is moved ahead from one contact to another. As will be noticed in the diagram, each one of the switch contacts connects with the rheostat resistance at a point in advance of that to which the preceding contact connects. Thus, 1 connects with the beginning of section *a*, 2 with beginning of section *b*, etc. If the resistance of the sections *a b c*, etc., of the rheostat is too great a proportion of the whole, when the lever *L* is moved forward one contact the increase in current will be considerable, because the section of resistance cut out will constitute a considerable portion of the whole resistance opposed to the flow of current through the motor circuit. This excessive increase in current will cause the speed to increase with a noticeable jump; therefore, instead of obtaining a gradual increase in velocity as the lever *L* is moved slowly from contacts 1 to 8, there will be a succession of jumps.

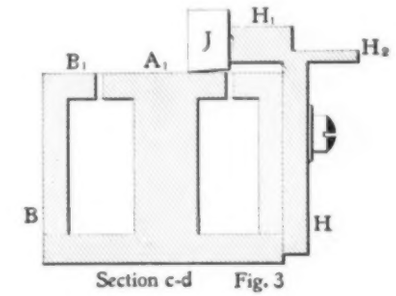
As it is not desirable from a mechanical standpoint to increase the complication of construction any more than is actually necessary, the number of contacts should be made as few as possible consistent with a smooth start. By making the resistance of each section greater than that of the one preceding it, the number of contacts can be reduced without producing too great a change from step to step. This can be readily understood when it is considered that at the moment of starting, when the lever *L* is on contact 1, the only resistance that opposes the current is that of the motor and the rheostat, while after the lever has moved forward, say to contact 5, the current is checked by the motor resistance, the amount of rheostat resistance remaining in the circuit and the counter electromotive force the armature may be developing at the time; therefore, a unit of resistance in section *a* will be a greater proportion of the whole resistance in the circuit than the same unit in section *e*, after the lever has been moved to contact 5 and the armature is developing a back pressure. This is true providing the total rheostat resistance is not enough to reduce the starting current to the normal point. Sometimes the rheostat resistance is so high that the starting current is considerably below the normal; in such cases nothing can be gained by making the resistance of the sections *a b c* increase as they progress. It is not necessary nor wise to make the rheostat resistance so great, because the starting current may be considerably above the normal without causing the motor to start off violently, even if running light; owing to the fact that the inertia of the armature, and that of the shafting and other apparatus driven by the motor, will resist the effort of a current much stronger than the normal, enough to prevent too rapid an acceleration. On this account it is desirable to make the resistance of the rheostat so low that the starting current may be about twenty per cent. above the normal. With the resistance so adjusted, it is evident that the current, when the lever is on contact 5, would be about four-fifths of its initial strength, supposing the motor were starting up under a full load, which is not always the case; therefore, the resistance of section *e* could be twenty per cent. greater that that of *a*, or even more, because generally a motor starts up without a load, and in such cases the current, when *L* reaches contact 5, would be probably not over one-half the normal strength.

The smoothness of starting in a motor does not depend wholly upon the construction of the switch and rheostat; the skill with which the lever is manipulated has a great deal to do with it. If the motor is started light, the lever can be moved around to the last contact faster than when it starts under a load. A man of ordinary intelligence can learn after a few trials with any particular motor just how slow to move the handle, to avoid increasing the speed by jumps. Most men make the mistake of moving the lever too slowly. It should always be moved around as fast as possible without causing the speed to jump, because the rheostats of simple starting switches are never made large enough to carry the current for any length of time; therefore, if the lever is moved too slowly, there is danger of burning out some of the sections of the rheostat.

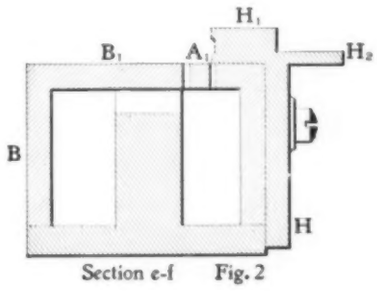
▲ ▲ ▲

Special Patterns of Walker's Magnetic Chucks.

We have received from Mr. O. S. Walker, whose magnetic chucks were described in our issue of July 16th, some additional drawings and particulars of modified forms of the appliance. The planer chuck already shown is recommended by Mr. Walker for all-around use, but in Figs. 1, 2 and 3 is illustrated a special form of chuck adapted particularly for a surface grinder, where the work is packed end to end; also for extremely thin pieces and pieces that require the edges to be ground absolutely square with the sides. The general construction of this chuck is similar to the first one described, except that the zig-zag air gap at the right of the central core is changed to a straight line. But one adjustable side-piece is used in this chuck (see *H*, Figs. 2 and 3). At the top edge of the piece *H* are formed horizontally projecting edges H_1 and H_2, of different thicknesses. The piece *H* is slotted for vertical adjustment, and is made reversible so that either horizontal edge H_1 or H_2 may be made to overhang the chuck face. By referring to the figures, it will be seen



Section c-d Fig. 3



Section e-f Fig. 2

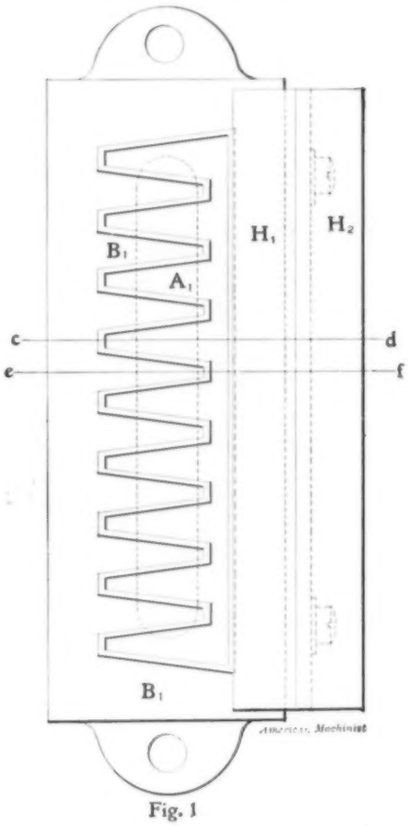


Fig. 1

WALKER'S MAGNETIC CHUCKS.

that the concaved face of H_1 is directly over the air gap.

The principle of operation of this chuck is as follows: Magnetic lines of force are being carried from the outer shell B by way of the polar face B_1 on one side, and by way of the side piece H upon the other, to the central pole A_1 of the magnet. The lines of force upon the right-hand side of the magnet are delivered through the edge H_1 of the piece H to a piece of work J (Fig. 3), attracting the same strongly against H_1 and insuring the work being held square, regardless of the shape of the under side of same.

This form of chuck will also hold a circular piece or round rod as firmly as a flat piece when in contact with H_1. It is intended to accompany the Norton Emery Wheel Co.'s universal tool and cutter grinder. It is wound for incandescent lamp circuits, and consumes a little less power than one lamp.

One peculiarity of magnetic chucks should be noted, *i. e.*, the thinner the piece the less the holding power; but with this chuck, by the aid of the edge holding piece (as H_1 made extremely thin), pieces have been ground to a thickness of a few thousandths.

The construction of the lathe chuck is shown in Figs. 4 and 5, which are from a drawing of a special chuck made somewhat deeper than usual. The ends of the coil are connected to the insulated rings *a b*, and the current is carried to them by the curved arm, which swings from a suitable bracket and carries contact pieces on its inner surface, as shown. A cross-shaped air gap is here shown, although a star shape is preferred for most purposes, as shown in Fig. 6.

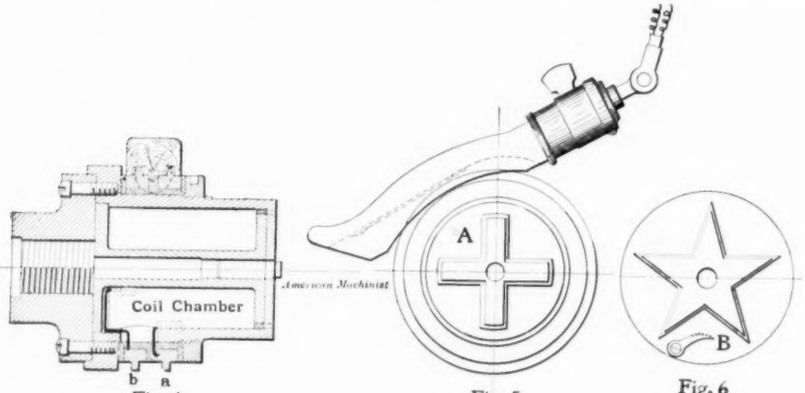


Fig. 4 Fig. 5 Fig. 6

WALKER'S MAGNETIC CHUCKS.

It will be remembered that in the previous article it was stated that, while the holding down power of the chuck is ample, some mechanical device is necessary to prevent shifting of the work under the strain of the cut. In Figs. 4 and 5 a small dowel pin A is shown in connection with a center pin, while in Fig. 6 is shown at B the thin-toothed latch which appeared in one of the half-tone engravings published in the previous article.

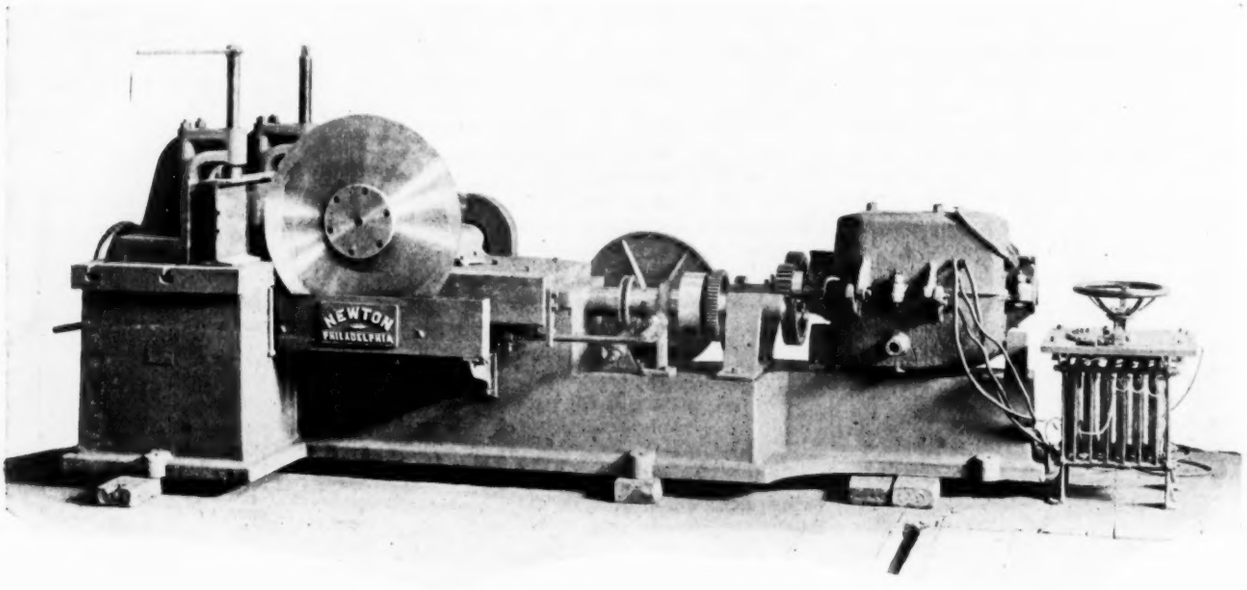
These chucks have been found so useful in the shops of the Norton Emery Wheel Co. that they have provided a special low-voltage dynamo for energizing them, as Mr. Walker prefers to use a lower voltage than that supplied to lamp circuits, although the chucks can be wound to use the full lamp pressure if desired.

▲ ▲ ▲

Electrically-Driven I-Beam Cold Saw and Automatic Saw-Sharpening Machine.

The first of accompanying illustrations shows a new cold saw cutting-off machine built by the Newton Machine Tool Works, of Philadelphia, adapted for cutting off I-beams, girder rails and general structural work.

The illustration shows an I-beam clamped in position ready to be cut. The beam is clamped in an upright position with a clamping apparatus attached to the machine, and the milling cutter or saw feeds through the beam in the shortest direction. With this method of cutting, an I-beam or girder rail can be cut off quicker than by any other method of slow-speed saws used. This is classed as the No. 2 I-beam cold saw cutting-off machine and will cut off I-beams up to 20 inches on straight cuts. By removing the clamp, beams or other work can be cut off at an angle within the capacity of the machine, which is governed by the depth of the cut. The saw on this machine is 30 inches in diameter, has a very heavy spindle, and is driven with cut-steel gearing and phosphor bronze double-lead worm wheel with Harveyized steel worm. It has a variable automatic feed, which can be changed instantly from one extreme to the other to

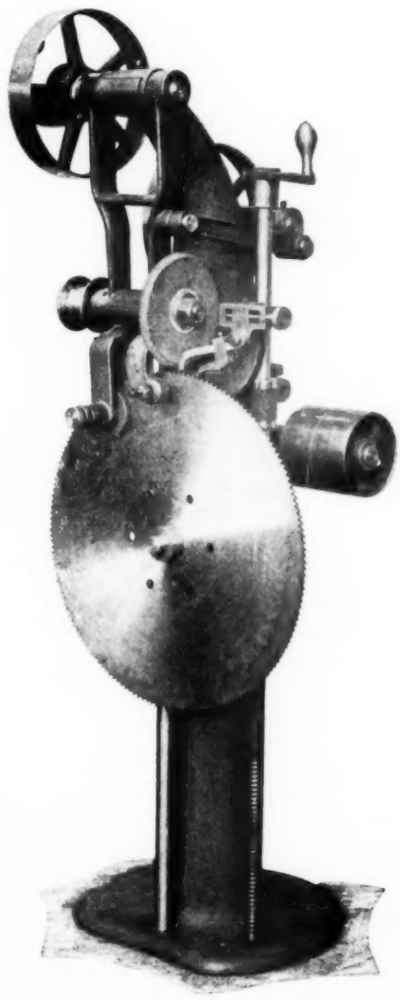


ELECTRICALLY-DRIVEN I-BEAM COLD SAW.

suit the different sections of work to be cut, and has a power friction quick return which is controlled by a lever at either end. The machine has a base extended to carry the motor for direct-coupled driving, a General Electric Co.'s motor being shown in position. When desired, the machine is, however, arranged for belt driving.

The automatic saw sharpening machine shown in the second illustration, is a companion machine to the cold saw.

The emery wheel for grinding is carried on a swinging arm, which is operated back and forth over the saw by means of a crank shown in the rear. The counter-



AUTOMATIC SAW-SHARPENING MACHINE.

shaft is on the side of the frame, and the machine is entirely belt-driven. The saw is carried on a saddle which can be adjusted vertically to suit any size of saw. The emery wheel passes over the tooth, and upon its return operates with an eccentric and the two leather disks which are clamped on each side of the saw, to draw the saw over the pawls one tooth at a time, bringing the saw up and holding it in position. The throw of these disks can be regulated to suit any pitch of tooth.

A valuable feature to this machine is the double pawls, as in many cases a tooth or more may be broken from the saw, and if only one pawl were employed the automatic feature would be of practically no use, as the machine would have to be watched and operated by hand when the broken tooth was reached. With this arrangement the second pawl can be set back several teeth, so as not to miss any broken teeth. When the front pawl does not engage, the back pawl will. This machine being entirely automatic, saws can be ground quickly and accurately. It can be used not only for the saws of iron sawing machines, but also for grinding saws for wood-sawing machines if desired.

▲ ▲ ▲

Letters from Practical Men.

Testing Indicator Springs.

Editor American Machinist:

I send you a view of a little apparatus for testing indicator springs. The importance of exactness in these springs in the trials of consumption of steam engines has led me to design this apparatus. The first idea of it came to me when I saw the manner employed by Professor Dwelshauwers Dery, of Liége. Many engineers make trials of engines, and it results frequently that their springs show unlike deflections from one trial to another.

The apparatus is composed of a light and well-balanced frame, bearing by the point *A* upon the piston *B* of the indicator. The frame has at the bottom a hook *C*, to which may be suspended weights proportional to the load of 1 kilo. per square centimeter surface of the little piston *B* (14.223 pounds per square inch). As shown by the figure, the apparatus is suspended to a piece *D*, fastened to a wall or to any other support.

It is very important to operate while the indicator is hot. Also, after heating the indicator, the exact diameter of the piston must be carefully measured, because upon this measure depends the whole accuracy of the operations.

One must also take care to oil well the piston and all the joints of the indicator. Each time that the frame has been loaded with a weight equivalent to 1 kilo. pressure on the piston (taking into consideration the weight of the frame), we draw with the pencil of the indicator a slight line upon the paper on the drum; we add then the weight necessary to obtain 2, 3 or 4 kilos. per square centimeter pressure on the piston. Before each operation, we must also take care to compress the spring and then allow it to come back to a stable position.

I. WALTON,
For A. Bollinckx.

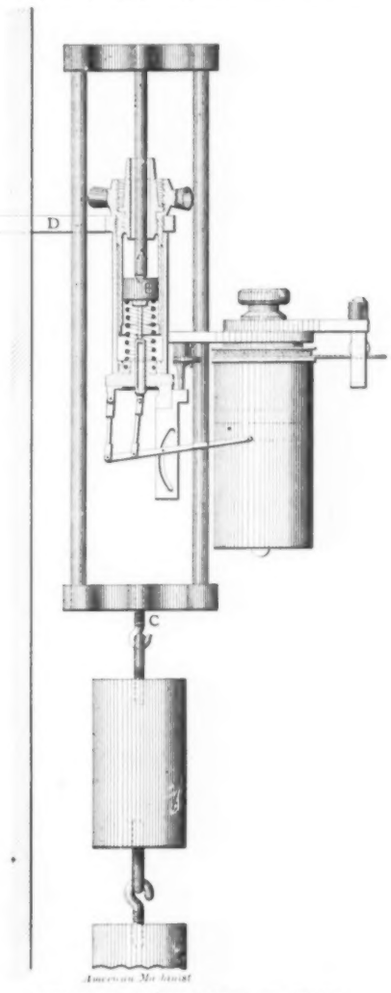
Brussels, Belgium.

[Our esteemed correspondent seems to have sent the above simultaneously to "The Engineer," London, and to us. We notice it in the issue of "The Engineer" for July 17th.]

Quarter Twist Belts with Idlers.

Editor American Machinist:

We notice, in reading over your valued paper (June 11th issue), that in your answer to "A. A., Beloit, Wis.," you state that you "have never known a quarter twist belt as wide as 18 inches to run satisfactorily, either with or without an idler or carrier pulley." We do not wish to discuss the particular problem of "A. A.," but we would like to state that we think someone is misinformed regarding the successful running of quarter twist belts. Without going into detail, we beg to mention that there are at least seventy-five of the most modern and successful



TESTING INDICATOR SPRINGS.

power buildings, in this city alone, that are transmitting the power to the various floors by means of a vertical shaft system, and in every instance, without exception, the power is taken on and off by "quarter turn" belts with properly designed and correctly set idlers. The amount of power distributed in this manner varies from one or two horse-power up to several hundred, and the loss of power in transmission distributed in this manner, under certain conditions, is reduced to a minimum. We quote you a few buildings that are transmitting all their main

power in this way, and in each instance the question of the transmission was most carefully considered by reputable engineers. We are pleased to refer you to such prominent buildings as the Rhinelander Building, Scott & Bowne Building, Metropolitan Realty Co., Puck Building, Judge Building, Police Gazette Building, Arbuckle Bros. Building, Frank Leslie Building, Gray Lithograph Building, Trinity Estate Building, and many others equally as prominent, all in this city. The buildings vary in height from seven to sixteen stories, and the amount of power distributed is, say, 50 to 350 horse-power.

CHAS. H. MOYER.
Geo. V. Cresson Company.
New York.

[The accompanying sketch shows, in plan and elevation, the first drive in one of the buildings mentioned above. It will be noticed that two vertical shafts are driven by the quarter twist belts, one shaft turning in one direction and the other the reverse. These shafts extend upward sixteen stories, power being taken off, also by quarter twist belts, at each story, the heaviest driving being done in the upper stories. The idler pulleys, giving the proper direction to the belt and taking up the slack of the loose side, allow the engine to be reversed without running the belt off. Evidently, we owe an apology to the idler pulley, or, apparently, to a host of them.—Ed.]

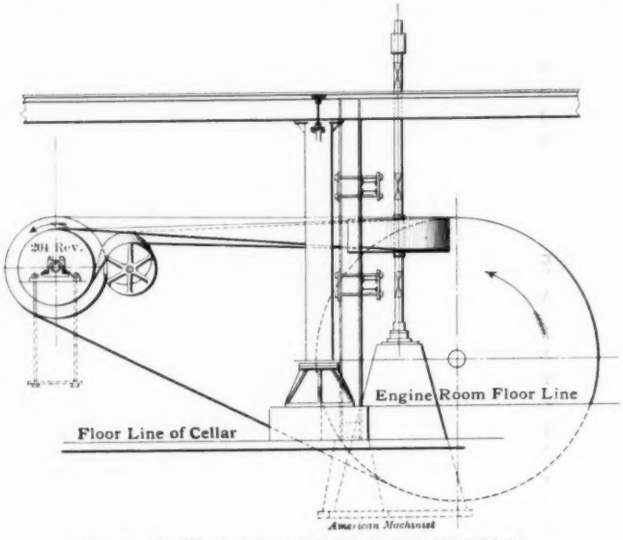


Fig. 1. ELEVATION—QUARTER TWIST BELTS.

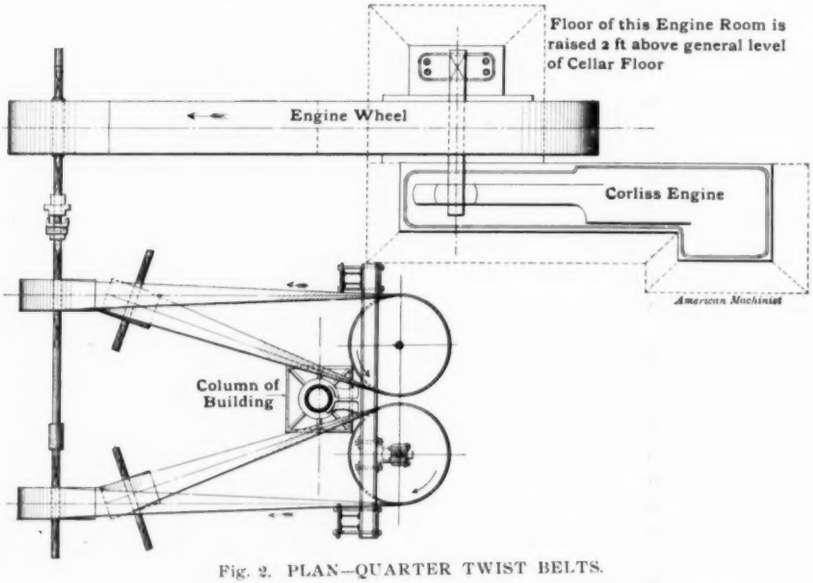

Floor of this Engine Room is raised 2 ft above general level of Cellar Floor
Engine Wheel
Corliss Engine
American Machinist
Column of Building

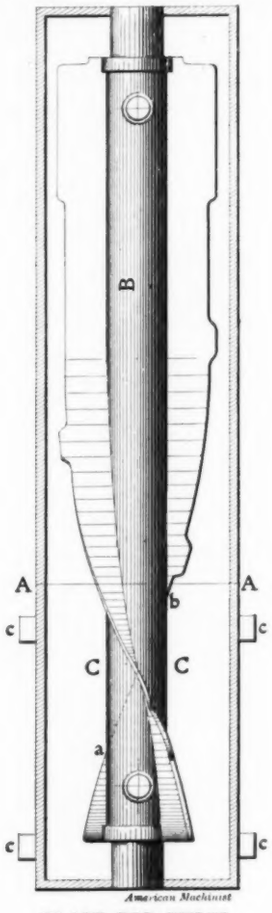
Fig. 2. PLAN—QUARTER TWIST BELTS.

"How to Mold It."

Editor American Machinist:

Inclosed please find a cut from "American Machinist" as to "How to Mold It." I have marked in a somewhat blurred way the cut in the "American Machinist" but I think you can get my idea.

The parting of flask, it occurs to me, should be in the copes only, besides the regular straight joint between nowel or drag and cope. Leave a section of the flange loose and in two pieces, to enable to draw easily, as marked by dotted line *a b;* this would be in the nowel part of flask and could be drawn separately. Ram up nowel on a mold or follow-board that will follow the lines or edges of the flanges to point of dotted lines marked *A A* (flask should be wide enough to permit of good bank for joint, not too steep, as you approach the terminal at *A A*). Then put



FLASK FOR HELIX.

on two copes with hinges *c c*, intersecting with hinges on the nowel, and follow the top of the flange, with the joint between these hinged copes. Have a piece of sheet iron to make partings at *A A*, and also between copes. Cut out to fit close to pattern. When rammed up, open by lifting off cope over *B* at *A A;* a bevel joint should be made. Roll off copes *C C* and draw main pattern, leaving the short section of the web marked with dotted lines *a b* to be drawn and the only loose piece on the pattern.

This seems to me to be a feasible and good way to mold this piece. Just where to make line *A A* is a matter to be determined by the parties handling the pattern. I would recommend iron flasks, fitted up to a nice close working point.

L. C. JEWETT.

▲ ▲ ▲

High Speed in Drilling.

Editor American Machinist:

I have found out at last the reason why we failed to get results from the hog-nose

drill with oil-feed arrangement, mentioned in my letter which you were so good as to publish in your issue of July 23d. We did not have the sense to see that after increasing the speed and improving the working of the rig by so doing, the thing to do was to go on and increase it some more. Mr. Lobben tells us in your issue of August 6th that ¾-inch drills, when made in this way, may be run at 900 turns per minute, and with drills only a little larger we stopped at 150. I have been searching for information on this subject for three or four years, and am glad to find it at last, though when found it does not flatter my stock of horse sense enough to do it any harm. To find how near you have been to success, and how you have missed it by letting your reasoning faculties go to sleep, is one of those things that brings on "that tired feeling."

SUPERINTENDENT.

▲ ▲ ▲

Arbor Practice—Oiling Drills.

Editor American Machinist:

The article in the issue of July 23d, bearing on the subject of arbors, deals with several troublesome features of the matter in a helpful way, giving suggestions that are in line with present practice in the production of duplicate parts of manufactured machines.

Given fifty spoked gear wheels to make, 6-inch pitch diameter, 1½-inch face; hub 2½ inches long, with 1¼-inch hole, having 5-16-inch straight keyway and two set screws to bear on key: The first pair or so were bored, turned, cut, key-seated and set-screwed in the order named, in the usual way, and were out of true when in running position. The present method is to drill, rough-bore and turn, and face rim both sides, and hub one end, at one chucking in turret lathe; the reamer is then run through on the drill press, keyway and set-screw holes made. The wheels are then slipped onto a straight-ground arbor having a flattened surface for a seat for a thin key held by the set screws, and upon this arbor the wheels are finish-turned and cut, with the result that they run practically true. Wheels having driven keys are, of course, keyed to the arbor under as nearly as possible the same conditions as when in position to run.

The discussion of the subject goes to show that every phase or process of manufacture requires special handling to get correct results, and no one method is right for all, as, while the above will get good results for wheels attached to rotating shafts, the method is wholly wrong for wheels running on stationary shafts or studs—the finishing and cutting of such wheels is better done on something in the nature of an expanding mandrel.

The objection to the split hub mentioned in the article referred to is that it is not applicable to any wheels but those having spokes or projecting hubs, and then there is a tendency in the strain of the bolts to spring a section of the rim.

For deep drilling in the lathe, turret lathe, etc., when a pump is available for oil, a straight-fluted or "Farmer" drill is better than a twist drill having oil supply pipes such as shown in recent issue of your paper. A straight drill is stiffer against lateral strains and acts somewhat in the same manner as the common drill. I recently fitted up a $\frac{31}{32}$-inch drill for drilling a hole 13 inches long through a machine steel sleeve, by "tacking" an ⅛-inch tin tube into one of the flutes with solder, and connecting it to the oil pump on the lathe, getting good results.

JOHN F. MCNUTT.

Warren, O.

▲ ▲ ▲

Inventor of the Pelton Water Wheel.

Editor American Machinist:

I see that in the "American Machinist" of July 16th you for the second time refer to the statement made in the "Engineer," that the Pelton water wheel "could not have been originated by a scientifically educated engineer."

I have been informed by what I believe to be undisputable evidence that the original drawings were made by Professor Hesse, of the University of California, and that from these drawings the first buckets were made of sheet metal and screwed to a wood wheel. As many of your readers may not know, I will add that Professor Hesse is a man of the highest scientific attainments, and that his specialty is hydraulics.

The wheel, after the first trial wheel proved its merits, was put into its present form by Mr. Pelton, which perhaps gave him a legal right to the patent and maybe to the profits, but certainly not to the credit bestowed by the London "Engineer."

Mr. John Richards has shown in his articles published in "Industry" that the same fundamental principle—that is, the fact that to make the wheel the most efficient it should run at half the velocity of the water, and the brackets so formed as to leave the water and discharge it without velocity—was set forth in a patent granted to a poor inventor whose name I am ashamed to say I cannot call to mind, but the patent was on a turbine wheel and not the uninclosed impulse sort, of which the Pelton wheel is the first in which the principle was applied. As the patent above referred to was never promulgated to any extent, it is not likely Professor Hesse was conscious of its existence, and if not, the Pelton wheel was purely a scientifically developed invention, developed by a thorough scientist.

JOHN E. SWEET.

[That the Pelton wheel is the work of a scientifically trained engineer is new to us and of decided interest. Apart from the question of the kind of man who originated the invention, we do not understand that its merit consists of its being an impulse wheel, but of the manner in which that principle is taken advantage of in its mechanical construction. The European Girard wheel is just as truly an impulse wheel as the Pelton, but the Girard wheel shows in its every detail the effect of the turbine rut, and such advantages as it has over the turbine are those which are inherent in the impulse principle and could hardly be avoided by any effort. Thus it avoids the running joint under pressure, and it is a "partial" wheel—that is, as many or as few buckets are used as required. In place of the simple nozzle of the Pelton wheel it has, however, an expensive gate box which must be specially designed to suit every condition, and each condition to be met requires a new wheel with the same complete arrangement of pattern and core boxes that the regular turbine does. In the Pelton wheel all turbine traditions, not only of the action of the water, but of mechanical construction as well, are abandoned, and an entirely new structure is the result, whose chief and remarkable characteristic is the flexibility with which it can be adapted to different conditions.—Ed.]

▲ ▲ ▲

The Landis Method for Deep Drilling.

Editor American Machinist:

In reply to "Superintendent's" communication in your issue of July 23d, I can say that I had the same experience with Mr. A. B. Landis's method for long boring in machinery steel. The adhering of the stock to the back of the drill, or to the cutting edge of forming cutters, is in the nature of the tool steel used. As an experiment, I hardened one drill with cyanide of potassium, thinking the hardness might have some effect on it. The stock still adhered, and the drill was too hard for use. I had the firm get me some of my old favorite steel, and the difficulty of adhering was successfully overcome. It taught me a very useful lesson: I found high speed, fine feed, plenty of good lard oil, rigid drill, narrow-step cutting edges, with very little angle to overcome the pressure against the back of drill, similar to a counterbore, and a true starting hole, to be necessary for success.

G. S. BOESCH.

[Will Mr. Boesch please tell the brand of steel with which he made the Landis plan succeed?—Ed.]

▲ ▲ ▲

The Holman friction-geared locomotive was given another trial at Cape May a few days ago. The distance run was a little less than 12 miles, which was made in 11 minutes. It was claimed that a speed of 94 miles per hour was attained.

American Machinist.

Published every Thursday
by the

American Machinist Publishing Co.,
256 Broadway, New York.

Angus Sinclair, Pres't. John A. Hill, Treas.
C. A. Hansmann, Sec'y.

C. P. Day, Manager Adv. Dept.

Fred J. Miller, Editor.

Frank Richards,
F. A. Halsey,
Edward P. Buffet,
} Associate Editors.

A. L. Donnell, Dept. of Illustration.

▲ ▲ ▲

Space in advertising pages only is for sale.

We invite correspondence on subjects pertaining to machinery.

Name and address must always be given, though not necessarily published.

Communications for or relating to the reading columns should be addressed to the Editor. All business communications should be addressed to the Company.

Subscribers can have their mailing address changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once. Date on wrapper denotes week with which subscription expires.

▲ ▲ ▲

SUBSCRIPTION PRICE:

$3.00 a year in advance, postage prepaid in the United States, Canada and Mexico.

$4.00 a year to other countries, postage prepaid.

Entered at Post Office, New York, as second-class mail matter.

For Sale by Newsdealers, Everywhere.

No back numbers beyond 1895.

▲ ▲ ▲

Quality of Goods for Export.

It is a most curious trait of human nature, that orders from a customer at a distance are, by some, considered less worthy of careful attention in filling than those from sources nearer home. If the customer is so far away that he cannot help himself, and has no redress so far as that particular order is concerned, traders of a type all too common will often fill an order for some staple article with the worst trash that can be found in the market. Customers from distant markets cannot know the names and values of different brands, and their orders must, in the nature of things, leave a large amount of discretion with the shipper as to what brand shall be supplied. Under these circumstances, the temptation is great to fill the order with a cheap brand of goods because of the larger margin of profit in them.

We were recently in conversation with a gentleman from an English colony, which, however, is much nearer New York than London, and has regular steamer connection with New York, while it has none with London. New York is its natural market for the purchase of supplies. This gentleman had occasion some time ago to order some leather belting in connection with a plant of machinery, and the belting was ordered from New York. This order was obviously filled on the plan described above, for the belting proved of very inferior quality, and the party described was, in consequence, full of denunciation of American belting. He knew nothing of brands, but having had had poor results, he assumed, and cannot be blamed for it, that American belting was poor stuff, and in consequence had, at the expense of greater delay and cost for carriage, obtained further supplies from England. Export trade is a matter of more importance in England than here, and his second order was filled on a different basis. His English belting proved entirely satisfactory, and now nothing can convince him that American belting is not hopelessly inferior to English.

Now, we know, of course, that there are American belting houses in which two generations of men have grown gray in supplying goods of the finest quality; but by the short-sighted, not to say dishonest, policy of one dealer to gain a trifling amount on a single sale, a market is practically closed to American goods, for the gentleman here referred to is a man of influence and a leader in his business, which is a leading one of his colony.

At a time when American manufacturers are looking abroad for business to a greater extent than ever before, this policy deserves notice and condemnation. In such business, buyers cannot usually deal with manufacturers, orders for a varied assortment of goods going, of necessity, through a supply or commission house, and to a large extent the reputation of American goods is in the hands of such houses.

▲ ▲ ▲

"Theory and Practice."

No expression is more hackneyed and none more distasteful to the all-around engineer than the one which forms the ttitle of this article. Theory is looked upon on the one hand as the explanation of facts, and on the other as synonymous with hair-splitting and useless speculation.

In this latter sense, it is curious to one who endeavors to view such things from the outside, to note the dividing line between theory and practice in different men's minds. With too many of us, practice may be defined as what we know, and theory as what we do not know. It is a case of the old definition, revised, "orthodoxy is my doxy, but heterodoxy is your doxy." It seems to be a natural tendency to consider one's own attainments as of importance and hence practical, while those things which are beyond our ken are of little importance and hence mere theory. This line of distinction is by no means confined to the uneducated. On the contrary, men with some—perhaps considerable—mathematical knowledge, will use that knowledge in everyday work and congratulate themselves on their possession of a most useful tool, but at the same time will look on someone else who uses higher mathematics than they are acquainted with as a "mere theorist."

The habit of hair-splitting is by no means confined to the educated. On the contrary, it would be easy to name men who pride themselves on being of the most practical got-it-all-by-hard-knocks type, who in their own work will indulge in refinements and speculations to the end of the chapter. There are men in plenty to whom the application of a Fairbanks scale and the Rule of Three to a problem, will cause them to shout "Theory," but who at the same time enjoy nothing so much as speculations of the most gauzy kind. On the other hand, others are just as easily found who swing their calculus like a college professor, and who, if not employers themselves, are held in the highest esteem by their employers for the results they have achieved.

The "theoretical man," in the offensive sense, is the one who indulges in useless refinements of any nature, and the practical man is the one who accomplishes valuable results. The real difference is in the mental make-up of the man, and not in his education or training.

▲ ▲ ▲

Japan as an Industrial Factor.

Japan and the imagined miraculous facility with which she is to make herself a fearsome competitor in manufacturing, still occupies the thoughts of many worthy people, and much ink is being spilled to prove that all the engineering and technical skill that have been so laboriously acquired by other peoples can in a year or two, or perhaps a few months—nay, even now is to some extent set at naught by these crafty Orientals, and that we shall soon have little to do but to sit down and starve while they deluge us with their cheap goods.

As we have previously pointed out, however, trained observers—men capable of looking below the surface and distinguishing between the genuine and a mere sham imitation, and who know something of the arts involved—do not fear this inundation.

Much is made of the very low wages paid in Japan; but if anything is to be feared on the score of Japanese wages, it is much more likely to be found in the fact that wages there are rapidly rising, both as a result of the recent war and the demand for skilled labor caused by an awakening to the importance of cultivating the modern industrial arts. For our belief is that highly-paid labor, i. e., labor which earns and receives relatively high wages, is most to be feared in industrial competition; which is only another way of saying that well-paid, intelligent and highly-skilled labor is most efficient—and this is our belief.

A nation may produce and export largely those crude things requiring for their production a low degree of skill, and the men who do the work will have

a very low standard of living, few ambitions beyond a stomach filled with coarse food, and be satisfied with low wages. But as the industries of such a nation come to depend more and more upon skill of hand and education of brain, the workmen will certainly want to enjoy a share of the things produced by them—will want to have in their homes some of the things made for the adornment and comfort of other homes—and this ambition, this raising of the standard of living, will inevitably cause wages to go relatively higher. Just this is said to be taking place now in Japan, and, moreover, that while Japan's exports have increased of late, her imports have increased in still greater proportion.

▲ ▲ ▲

Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer questions by mail.

(143) J. T. G. writes: I have a shaft 6 inches diameter, 243 feet long, that is to transmit 1,300 horse-power at 158 revolutions per minute. First there is a section of 9-inch shaft to which the power is applied; 10 feet from this, 300 horse-power is taken off by a pulley; 112 feet further out, 200 horse-power is taken off; and 121 feet further out, 800 horse-power is taken. Is the shaft large enough, and how much power should such a shaft transmit? A.—Assuming the shaft to be of turned iron, and that there are bearings close to all the pulleys to resist side pull of belts and ropes, we may use the formula given by Jones & Loughlin for a wrought-iron shaft simply to transmit. The formula is

$$D = \sqrt[3]{\frac{50\ H\text{-}P.}{R}}$$

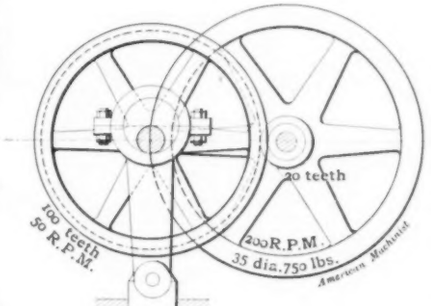
in which D is the diameter and R the revolutions per minute. Applying the formula to this case, we have

$$D = \sqrt[3]{\frac{50 \times 1,300}{158}} = 7.43$$

or practically 7½ inches, which should be the size to the first pulley. To the next pulley the shaft has to transmit 800 + 200 − 300 = 700 horse-power; and applying the same formula, we find that 6 inches is right for this section, and the shaft might be reduced a little for the remainder of its length.

(144) W. C. K., Hastings, Mich., asks: What is meant by running with vacuum alone? Is it with the exhaust pipe coupled to condenser, with no steam connection? A.—No. What is usually meant is that steam is supplied to the cylinder at or below atmospheric pressure. It is, of course, not correct to say that vacuum runs the engine in such a case, because a vacuum cannot do work. It is the pressure of steam which does the work; but if this pressure is at or below atmospheric pressure, then the pressure in the so-called vacuum or in the hot well must be still lower in order that there may be an unbalanced pressure to move the piston. If the exhaust pipe were connected to a vacuum and there was no steam connection, then the atmosphere, if admitted to the cylinder, would drive the engine equally as well as steam at the same pressure, so long as the vacuum could be maintained; but as the air, when it passed through the cylinder to the condenser, could not be condensed, but would have to be removed by pumping it out against the resistance of the atmosphere, nothing would be gained. But in any case it is well to remember that a vacuum is nothing, and that it can do nothing. It is steam or other pressure that does work. It should also be always borne in mind that steam at 0 pressure by gage is really steam at about 15 pounds pressure absolute—i. e., steam at the pressure of the atmosphere—and that when a boiler is shut off from communication with the atmosphere, and the air driven out of it by steam raised up to or above atmospheric pressure, the steam pressure within the boiler may then fall to anything below the atmosphere; but this steam at such low pressures will still do work in an engine, if only the pressure in the vacuum chamber connected to the exhaust is still lower.

(145) H. L. C., Boston, Mass., writes: Please state how to calculate maximum pressure which could be obtained from a plunger driven as in the inclosed sketch; also what percentage of loss of power by friction should be allowed for, the rubbing being all between steel and cast-iron surfaces. A.—There is no way that we know of to calculate the maximum pressure that can be exerted by the plunger in this case. So far as the driving mechanism alone is concerned, the maximum pressure might be nearly or quite infinite in amount, and the actual maximum will depend upon how stiff the machine can be made to resist flexure or distortion. The pressure that can be exerted by the plunger at any given point of its travel can be arrived at



theoretically by ascertaining what its rate of movement is at the given point, relative to the rim of the wheel, if we assume that the wheel is driven with a given force, as with a belt, disregarding its stored energy as a fly-wheel. Taking the mid position of the plunger, for instance, and neglecting the effect of the angularity of the connecting rod, the speed of the plunger in relation to that of the rim of the first wheel to which the force is applied would be as 2 is to 87.5, and assuming the wheel to be moved with a force of 750 pounds the force exerted by the plunger would be 2 : 750 = 87.5 : 65,625 pounds. But taking it as a fly-wheel weighing 750 pounds, and running 200 revolutions per minute, the force it can exert will depend upon how quickly it is stopped, or, in other words, upon the rigidity of the machine; and for this reason, as well as on account of the fact that near the bottom of its stroke there is a toggle-joint action capable of exerting any force up to the limit of the strength of the machine, the problem is not solvable.

Business Specials.

Transient Advertisements 40 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Gear wheels, gear cutting. Grant; see page 7.

Forming Lathes, Mer. Mach. Tool Co., Meriden, C.

Milling Machs. Kempsmith Co., Milwaukee, Wis.

Honest Mach. Oils. F. S. Pease Oil Co., Buffalo, N.Y.

Engine Castings ½ to 2 H. P. Finished boilers and engines. Grant Sipp, Paterson, N. J.

Aluminum and Brass Castings, Machinery Name Plates. Twining Campbell, Paterson, N. J.

Presses and dies for bar and sheet metal work. Ferracute Machine Company, Bridgeton, N. J.

Just Issued—Catalog No. 8. Mailed free. Clayton Air Compressor Works, 28 Cortlandt st., New York.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

Form'g and reliev'g lathes for back'g off formed cutters; gear cutters for cutting 2 teeth at a time, any pitch, 2 to 48. R. M. Clough, New Haven, Ct.

Patent Soliciting of High Class.—D. Walter Brown, Counsel in Patent Cases, 111 Broadway, New York. Send for "Brief History of Patent Legislation."

For Sale or Rent—Foundry and Machine Shop with additional land; in good condition and well equipped for medium heavy work. Capacity of foundry, seven tons per day. Located on railroad within eight miles of New York. Terms easy. Call or address, Room 41, 22 William st., N. Y.

▲ ▲ ▲

Bids on and Award of Contracts for Army Gun Carriages, Gun Forgings, Mortars and Rapid-Fire Guns.

Bids were opened in Washington on the 3d inst., and found to be as follows:

For Ten-Inch Disappearing Gun Carriages—American Hoist & Derrick Company, St. Paul, Minn., ten or more, at $11,800 each; the Weimar Machine Works, Lebanon, Penn., thirty, more or less, at $17,250 each; the Bethlehem Iron Company, five at $16,800 each, or ten or more at $16,400 each; Robert Poole's Son & Co., of Baltimore, thirty, at $13,748 each; Cramp & Sons, Philadelphia, thirty, at $17,000 each; John H. Dialogue, Camden, N. J., five, at $20,300 each; the Kilby Manufacturing Company, Cleveland, O., six, at $17,500 each; the Morgan Engineering Company, Alliance, O., one for $18,500, or six for $17,180 each; the Pond Machine Tool Company, Plainfield, N. J., one for $24,147, ten for $169,470, and twenty for $330,940, if over twenty at $16,500 per carriage; the Southwark Foundry, of Philadelphia, one for $12,660, all above ten at $11,500 each; the Niles Tool Works, Hamilton, O., six, at $15,975 each, and each additional carriage at $15,175 each.

Motor Carriages—The American Hoist & Derrick Company, St. Paul, Minn., twenty or more, at $5,618 per carriage; the Weimar Company, Lebanon, Penn., all of the carriages, but not less than ten, at $8,500 per carriage; the Dixon Manufacturing Company, Scranton, Penn., ten spring return carriages at $8,950 each; Robert Poole's Son & Co., Baltimore, fifty-six or more spring return carriages, at $5,396 each; the West Point Foundry Company, Cold Spring, N. Y., twenty or

less spring return carriages, at $7,300 each; the Morgan Engineering Company, Alliance, O., one carriage for $8,150, or twelve for $6,980 each; the Walker Company, Cleveland, O., fifty-six, more or less, at $8,250 per carriage; Niles Tool Works, Hamilton, O., ten for $7,575 each, and additional carriages at $7,175 each; the Kilby Manufacturing Company, Cleveland, O., six twelve-inch carriages at $7,850 each; the Southwark Foundry, Philadelphia, one for $6,450, and all above ten for $5,750 each; the Pond Machine Tool Company, five for $41,244, or twenty for $151,780; the Builders' Iron Foundry, Providence, R. I., fifty or more at $6,136 each, less than twenty at $6,819 each.

Forgings for Ten, Twelve and Sixteen-Inch Guns—Bethlehem Company, eighteen sets of tens at 23.6 cents per pound, for twelve-inch, 23.9 cents per pound, and for sixteen-inch, 24 cents per pound; Midvale Steel Company, eighteen sets for ten-inch, 23.85 cents per pound, eighteen sets for twelve-inch, 23.65 cents per pound, and one set for sixteen-inch at 30 cents per pound.

Mortar Forgings—Bethlehem, sixty, more or less, for twelve-inch, 23½ cents per pound; Midvale, sixty sets, at 29.3 cents per pound.

Finishing and Assembling Twelve-Inch Mortars—Builders' Iron Foundry, Providence, R. I., thirty or more, $3,759 each; less than twenty, at $3,875 each.

Completing Mortars—Bethlehem Iron Company, twenty complete, $12,250 each; over twenty, at $12,000 each.

Rapid-Fire Guns—American Ordnance Company, six-pounder, Driggs-Shroder type, $1,565 each; Thomas F. Lane, six-pounders, with mounts, Maxim types, $1,795 each.

The award for twenty-one sets of ten-inch steel gun forgings and for one set of forgings for a type of sixteen-inch gun was made to the Bethlehem Iron Company of Pennsylvania, the Midvale Steel Company receiving the award for twenty-one sets of twelve-inch forgings.

Under the comparatively favorable terms offered by these companies, the department is enabled to obtain six guns above the number that the appropriation was estimated to procure.

The same companies receive contracts for, respectively, twenty-two and fourteen sets of steel forgings for the twelve-inch, breechloading mortars. For finishing and assembling twenty sets of these forgings, a contract is awarded the Builders' Iron Foundry of Providence, R. I., the remaining fourteen sets going to the Government gun factory at Watervliet. In addition, a contract for thirty finished mortars is awarded to the Bethlehem Iron Company.

Thus it appears that, instead of sixty mortars, the comparatively low prices asked enable the War Department to procure sixty-six.

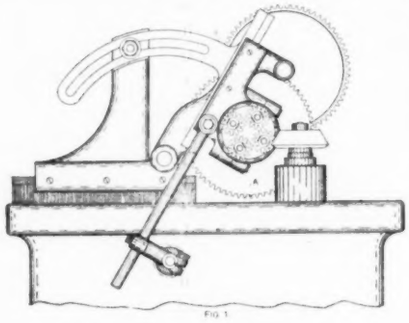
The ten-inch disappearing gun carriages are distributed as follows: Ten to the Southwark Foundry and Machine Company, to be delivered in nineteen months; eight to the Niles Tool Works Company, to be delivered in sixteen months, and twelve to the Bethlehem Iron Company, to be delivered in fifteen months.

The favorable bids received for the twelve-inch mortar carriages enable the department to procure sixty-seven of these, or eleven more than it was supposed the appropriation would provide. Of this number fifty-seven are awarded to Robert Poole & Sons' Company of Baltimore, the last one to be delivered within sixteen and one-half months, while ten go to the Southwark Foundry and Machine Company, the last one to be delivered within eighteen months.

▲ ▲ ▲

A New Bevel-Gear Cutting Machine.

We give on this page some engravings illustrating the principle of an automatic bevel-gear cutting machine, which was designed and built by Mr. E. J. O'Connor, of 119 Columbia Heights, Brooklyn, N. Y. At the time the machine was built, Mr. O'Connor was in Hartford, engaged on the "chainless" bicycle, which was in-



NEW BEVEL-GEAR CUTTER.

vented by him, and which drives by bevel gearing instead of by a chain and sprocket wheels. The primary object of the machine herewith described was to produce bevel gears of greater accuracy than those cut in the ordinary manner and yet keep their cost at a low figure. The method adopted is to use four cutters, or more if required, and cut a portion of the tooth with each cutter in succession, feeding each cutter through the blank that portion of the total face corresponding to the number of cutters used.

Fig. 1 gives an idea of the general arrangement of the essential portion of the machine, and it is seen here that there are four cutter arbors which are parallel to each other and fitted to bearings within a cylinder, which cylinder is arranged to rotate within bearings on the saddle, while a cam, which is formed on the inner side of the gear wheel *A*, draws the cutter out of the cut and feeds in new ones at the proper times as the cutting proceeds. This cam is shown at Fig. 2, with a section of the cylinder and cutter arbors.

Figs. 3, 4 and 5 illustrate the principle of operation, Fig. 3 being cutters, Fig. 4 a plan view of a space between two adjacent teeth, and Fig. 5 a side view of the same, with circles representing the cutters and the cuts taken by them. The saddle is, of course, fed upward at the proper rate, and when returned after the

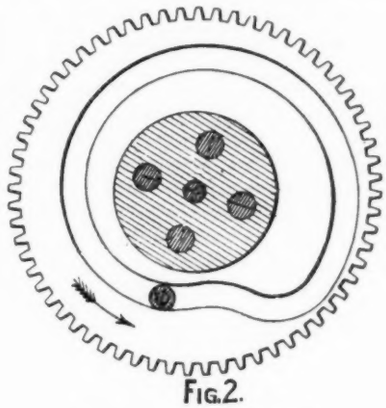


FIG. 2.

CAM FOR GEAR CUTTER.

cut, the blank is automatically indexed for the next tooth in the usual manner.

Referring to Figs. 3, 4 and 5, the first cutter approaches the gear blank on axial path *J*, cuts away the metal of the gear blank to the heavy dotted line *N*, and finishes that portion of the base of the tooth which lies between the end of the tooth and the dotted line *E*, Fig. 4, to nearly a straight surface. The second cutter *B*, which is somewhat smaller than the first

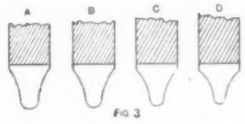


FIG. 3.

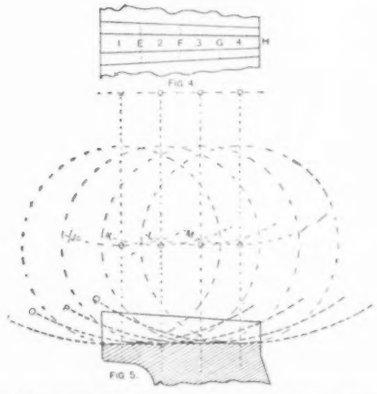


FIG. 4.

FIG. 5.

DIAGRAM SHOWING ACTION OF CUTTERS.

one, approaches the gear blank on the second axial path *K* and cuts away the succeeding portions of the blank as indicated by the second dotted line *O*. In like manner the other cutters *C* and *D*, which are of gradually reduced sizes, approach the gear blanks on succeeding axial paths *L* and *M* and cut away the blank as indicated by the third and fourth dotted lines *P* and *Q*, respectively. The

teeth of successive cutters, as shown in Fig. 3, are of gradually reduced width, and each cutter is of a width corresponding, respectively, to the width of the different portions 1, 2, 3 and 4 of the tooth space which it acts upon.

Regarding the effects produced by the machine, its inventor says:

"According to this process, carried out by means of a series of cutters of successive sizes, varying in degree to the successive portions of the cut to be made by said cutters, these being carried and operated as described, the successive portions 1, 2, 3 and 4 of the length of the gear tooth are each formed by a cutter especially shaped therefor, and the relation of each succeeding cut to the preceding one is such that the surfaces merge into each other, tangentially, in regular and gradual manner, producing substantially the same result as if the gear were cut by a planing tool operating upon lines radiating from the common center or focus of the gear tooth."

The machine being automatic, the cost of gearing produced by it is, of course, low.

▲ ▲ ▲

On Friday the 7th inst. the American line steamer "St. Louis" arrived in New York from Southampton, the time of the passage being 6 days, 2 hours and 24 minutes, which reduces the record previously held by her sister ship, the "St. Paul," by 3 hours and 8 minutes. The "St. Louis" had recently come from dry dock, and this, together with favorable weather, led to what was probably a special effort to reduce the time between Southampton and this port. It is stated that an average of 198 pounds of steam was maintained upon the boilers throughout the run by the consumption of 330 tons of coal per day, and that an average of 90 revolutions of the screws per minute had been maintained. One hundred and seventy-six men were employed in the engine department, divided into three watches of fifty-eight men each. Sixty-six of these are firemen, forty-eight coal-passers, twenty-one oilers and the rest engineers. The average speed of the vessel throughout the voyage is given as 20.867 knots per hour.

▲ ▲ ▲

The following example of perspicuity was perpetrated by the New York "Press" in its attempt to describe the Mexican Central's double locomotive: "The mechanical arrangement of the driving wheels was the chief difficulty met with by the builder. The crank shafts of the driving wheels are provided with immense ball joints near the cylinder heads, so that when the driving wheel assumes an angle other than 90 degrees in reference to the frame, the crank shafts connecting with the cylinder heads and the driving wheels follow the movement of the wheels without injury to the engine."

A press dispatch says that some Japanese have determined to secure for use in that country the best and most modern saw-mill plant and have asked the Menominee Iron Works, of Menominee Mich., to bid on such a plant, to include all the most modern features of such machinery.

▲ ▲ ▲

A grindstone burst in a wheelwright shop on West Forty-third street, New York, on July 31st, fracturing the skull of the man working at it so that at this writing it is thought that he cannot recover. The stone was of medium size, and the cause of the accident is not known. The factory is driven by steam.

▲ ▲ ▲

Mr. Edison is the authority for the statement that the perfecting of the incandescent lamp cost his company over a million dollars.

▲ ▲ ▲

Commercial Review.

NEW YORK, SATURDAY EVENING, AUGUST 8th.

Dynamos and Motors.

In view of the gloomy reports that have long been coming from almost all lines of business, the aspect of the electrical industry is rather gratifying. The tone assumed by some of the leading interests represented in this city is actually cheerful, and in one or more instances even buoyant. From the standpoint of one of the very large companies the trade of July this year is pronounced better in about all lines than that of July last year, collections being pretty good and, upon the whole, the hard times felt less than in other branches of business.

Now we do not mean to predicate anything sensational about the electrical market nor that this is, upon the whole, a good year for it; but when it is considered how other lines of trade are suffering—how the past month is stated to have been the dullest on record for the iron market in Pittsburg; how the Chicago Stock Exchange has closed its doors and Wall street has been on the verge of a panic—it would seem that the electrical manufacturers are better favored than many other people. It is true that some very unfavorable reports are received, and doubtless there is ground for them. It appears as though the smaller concerns, and the contractors were not generally as well off as the larger ones. But certainly the business of the latter is far from at a standstill.

There have been declines in electrical shares which are quoted upon the exchanges as there have been in other stocks; but this is a matter of speculation and due far more, we imagine, to the apprehension of general national calamities which may possibly happen, than to any of the present affairs of the companies.

The relative trade of July and June is a question as to which the experiences of the companies are not uniform. One concern which has been doing little business for some time past informs us that things have improved with it since two months ago; another company's orders have about doubled in the past week or two, attributed by them to a flurry of buying induced by low prices. But on the other hand there is recognizable, from some points of view, a cessation in trade during the midsummer period and the political upheavals that are taking place.

Isolated plant lighting work is still prominent in the market. Some of the orders are coming in now, but the impression is pretty prevalent that there will be more trade after the middle of this month.

The sale of dynamos specifically adapted to arc lighting has not loomed into prominence. There will doubtless be some of it for municipal purposes when the days grow shorter; but not a heavy trade in this class of machines is expected, for the use of incandescent circuits for this object, by private persons, is very popular, notwithstanding it is less economical from a theoretical point of view. But so long as some kind of dynamo is used for the purpose, it sufficiently well subserves the interests of the manufacturers.

Electric railway trade of the repair or extension sort, to which the business of the year has chiefly been limited, keeps on in a satisfactory manner, it is said. This is a line of work in which many companies do not participate, but those who do include some of the most important ones.

It is an open secret that the incandescent lamp people are forming a combination to protect their business interests. According to report the agreement has been completed up to its ratification.

The majority of sellers with whom we have communicated upon the subject of prices report an unchanged condition. To the contrary be it said, that a gentleman whose opinion carries weight infers from the bids in competition with his own company a general cutting to the extent of about 10 per cent. within a month past. On the whole we must consider prices as low as they have been in the past, though it is not safe to assert that they are generally lower.

The Thresher Electric Company, Dayton, O., take an optimistic view of the situation: "As far as we, ourselves, are concerned the demand for electrical apparatus at the present time shows a marked increase. Although there has been a tendency in some quarters to take work at almost any price, yet the demand for first class apparatus is very encouraging. Purchasers generally are willing to pay a good price for first class machines. The fact that the installation of electrical machinery for lighting and the transmision of power is the means of great saving in operating expenses, has a tendency to en-

courage the market in this class of apparatus. As soon as the important questions now before the country are settled we trust there will be a general increase all along the line."

Another Western company write as follows of the motor and dynamo trade: "We have only taken up the manufacture of these goods for the last three years and during that period the general business conditions over the country have not warranted us in pushing this branch as we intend later on. When free silver has been knocked out and the general run of business has resumed its normal shape, we intend to give the matter more attention. We hear that some factories are quite busy in these goods, but we know that the orders are taken with little or no profit in them, and of course this means very skilful management during the present time to weather the depression that has been existing and the heavier depression that we feel is coming on now."

Some reports received by us from other lines of mechanical industry, showing activity in certain quarters, are these: From the Link Belt Machinery Company, of Chicago, who have been operating their machine shops with two gangs of men day and night for the past three months, and from the Morris Machine Works, of Baldwinsville, N. Y., which are selling a large number of pumping outfits with engines directly connected, for various purposes, such as circulating, dredging, wrecking and sewerage work.

We compute the outward manifests of machinery from the port of New York for the week ending August 8th, at $233,984, against $124,672 for the previous week. The total was swelled by a shipment of 907 packages, valued at $90,040, on a single steamer, to Cape Town and elsewhere.

The iron and metal markets have been, for the most part, quiescent, and low figures rule.

Quotations.

NEW YORK, Monday, August 10th.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$12 00 @ $13 00
No. 2 foundry, Northern	11 75 @ 12 25
No. 2 plain, Northern	10 75 @ 11 00
Gray Forge	10 75 @ 11 00
No. 1 foundry, Southern	11 00 @ 11 50
No. 2 foundry, Southern	10 50 @ 10 75
No. 3 foundry, Southern	10 00 @ 10 25
No. 1 soft, Southern	10 50 @ 11 00
No. 2 soft, Southern	10 25 @ 10 50
Foundry forge, Southern	10 00 @ 10 25

Bar Iron—Base, in Carloads—Mill price, on dock: common, 1.10 @ 1.20c.; refined, 1.19 @ 1.35c. Store prices: common, 1.40 @ 1.50c.; refined, 1.50 @ 1.70c

Tool Steel—Ordinary sizes, standard quality, 5¾ @ 7c.; extra grades, 11 @ 12c.; special grades, 16c and upward.

Machinery Steel—From store, about 1.75. Special brands upward.

Cold Rolled Steel Shafting—Base size in carloads, about 2½c.; 2¾c. for smaller quantities from store.

Copper—Carload lots, Lake Superior ingot, 11 @ 11¼c.; electrolytic, 10¾ @ 10.80c.; casting copper, 10½ @ 10⅝c.

Pig Tin—For 5 and 10-ton lots, 13.40 @ 13.45c. f. o. b.

Pig Lead—In carloads, 2.80c.

Spelter—In carload lots. New York delivery 3.85 @ 3.90c. for standard Western brands.

Antimony—Cookson's, 7.25c.; Hallett's, 6.40c.; Japanese, 6.40c.

Lard-Oil—Prime city, present make, 39 @ 40c.

Manufactures.

The Schlicht Combustion Co., Titusville, Pa., intends to place a line of machinery.

House of Refuge, Baltimore, Md., are about to install boilers, pumps, tanks, stack, etc.

W. N. McAuge & Co., Suffolk, Va., are going to install new boilers, engines, pumps, etc.

T. Downs will build a new brewery cor. King and Albert streets, at Cobourg, Canada.

The Principio Forge Co., of Wheeling, W. Va., will install new machinery at an early date.

The H. H. Myers Co., Beaver Falls, Pa., manufacturers of shovels, will increase their plant.

Morris & Co., of Ellsworth, O., have decided to introduce the electric method in their mines.

A large tin plate plant is being built by the Ohio River Sheet & Tin Plate Co., at Remington, Pa.

The Pettit Ornamental Iron Fence Co., Philadelphia, Pa., will soon install a line of machinery.

The Alcania Terne & Tin Plate Co., of Youngstown, O., are contemplating enlarging their plant.

Frank S. Lord is about to build a large blacksmith and wheelwright shop at West Ossipee, N. H.

The Rawson Steel Mfg. Co., Philadelphia, Pa., will start business, and install a line of new machinery.

The Bradford Hardwood Lumber Co., Bradford, Pa., will erect a plant at once to manufacture bicycles.

The Pittsburgh Taper Tube Co., Pittsburg, Pa., will install new and improved machinery of the latest type.

St. Joe Valley R.R. Co., Benton Harbor, Mich., will erect large repair and car shops at Berrein Springs, Mich.

St. Thomas, Canada, will submit a by-law to the ratepayers for the establishment of a city electric light plant.

Robt. D. Hughes, Passaic, N. J., will start a silk mill at Euphrata, Pa., and will install a line of new machinery.

A new electric railway, seven miles in length, is soon to be built to connect Hudson, Lancaster and Bolton, Mass.

The Orphans' Home, Loysville, Pa., will erect a $10,000 steam laundry, and place all new and improved machinery.

The Waterbury Watch Co., Waterbury, Conn., closed down all departments of its plant on July 31st until September.

J. A. Dyer, Millersburg, Dauphin Co., Pa., will

(*Continued on page 39.*)

▲ ▲ ▲

Help Wanted.

Situation and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

TO SUBSCRIBERS

whose names appear on our subscription list, this paper will give two free insertions under this heading to those in want of positions. The advertisement to occupy a space of not more than five lines. Additional space or insertions must be paid for in advance at regular rates.

Compt. draftsman, wants pos'n. E. E., AM. MACH.

Wanted — Situation by a machinist. J., 526 Seventh street, So. Boston, Mass.

Exp. mech'l engineer, speaking Spanish, wishes to change; best references. BOX 250, AM. MACH.

Mech. dftsman, wishes a change; all-round man, gen. and elec. machy.; 20 yrs.' exp. B. M., AM. MACH.

Pattern maker and draftsman desires a change; can design either machinery or office furniture. BOX 248, AMERICAN MACHINIST.

Wanted—By the Nellis Belt Fastener Co., 284 Pearl street, New York, hustling salesmen on their patent fastener and pulley covering.

Wanted Situation—Toolmaker (30) to grow up with mfg. concern; has had charge of manufacturing of light machinery. BOX 251, AM. MACHINIST.

Designer and Draftsman wants pos., 12 years ex. on engines, tools and spec. machinery, capable in charge of work. BOX 252, AM. MACHINIST.

Wanted—Position as iron molder, green or dry sand, light or heavy work; 25 years' experience both as foreman and workman. BOX 249, AM. MACH.

Wanted—Experienced milling machine hand to take charge of a plain mill and three gear cutters in the West; permanent position to a reliable man. BOX 246, AMERICAN MACHINIST.

Situation wanted by toolmaker (35) foreman, had charge of tool, model and experimenting work, with cycle manufacturing concern for the last 6 years. BOX 254, AMERICAN MACHINIST.

Wanted—Position as supt. of foundry and machine shop or iron and wood-working establishment, by mechanical engineer of extensive experience. Address BOX 253, AMERICAN MACHINIST.

Practical machinist, good address, technical education, exper'ced in mech'l and civil engr'g work, desires pos. as trav. salesman with mfg. concern; has had some experience. Ad. BOX 244. AM. MACH.

Foundry foreman, Amer., age 38, ex. and competent, would like to make change about Sept. 1st; engine or ma. work, green sand, dry sand or loam; understands chemistry of iron and mixing and melting of same; good ref. Address BOX 255, AM. MACH.

Wanted—A young or middle aged man as designer, by concern building high grade machine tools. Must have had considerable experience in designing modern high grade tools. A splendid position for a strictly first-class man, with an opportunity to become interested in an established business. When writing, state age, experience fully and salary expected. BOX 256, AMER. MACHINIST.

▲ ▲ ▲

Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd lathes & planers. S.M.York, Clev'd, O.

Calipers & Gauges. F. A. Welles, Milwaukee, Wis.

Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Boye, Cincinnati, O.

For Sale—Part or all of a first-class plumbing and machine shop in a live city, Central Illinois. Ad. G. H., AMERICAN MACHINIST.

Wanted — A second-hand radial drill. State maker of same, condition, cash price. Middletown Machine Co., Middletown, Ohio.

We make a specialty of Shartle's patent safety set collars. Prices low and samples free. Middletown Machine Co. Middletown, Ohio.

Cheap for quick sale.—1 Wheeler Planer 42 x 42, very heavy, first-class condition; cost $1,900, will sell for $650. Butterworth & Lowe, Grand Rapids, Mich.

We offer an exceedingly fine lot of first-class second-hand machinery, lathes, planers, shapers, drills, millers, screw machines, etc. Call or get list 17 B. The Garvin Mach. Co., 440 Canal st., N. Y.

A VALUABLE BOOK

NEARLY READY.

Gas, Gasoline and Oil Engines

By GARDINER D. HISCOX, M. E.

400 Pages. 200 Illustrations. Price, $2.50.

This book treats comprehensively, and almost entirely of American makes of Gas, Gasoline and Oil Engines, with instructions for the care and management of the same.

The author has probably had more experience with the manufacture, care and management of Engines of the above type than any other man connected with the subject.

ADVANCE ORDERS SOLICITED.

Send for our catalogues and special circulars of books for Machinists, Engineers, Electricians, and all practical trades.

NORMAN W. HENLEY & CO., Publishers,
15 Beekman Street, New York.

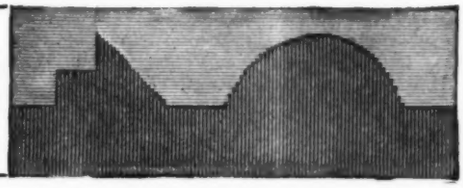
IMPROVED

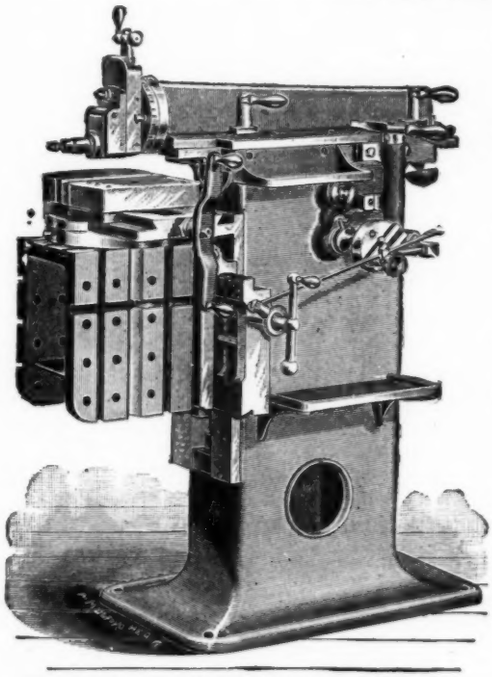
15-inch Hendey Shaper

LATEST IMPROVEMENTS.
USEFUL ATTACHMENTS.
STRONG AND POWERFUL.

For Die Work, Tool Room, or General Machine Shop Work.

This Cut shows how stroke can be Adjusted with Machine in motion by the Micrometer Adjustment, fine and delicate.





The Stroke can be adjusted for Curves with machine in motion.

The Stroke can be adjusted for Angles with machine in motion.

The Stroke can be adjusted for Irregular work with machine in motion.

It has Adjustable Table for planing Taper Work.

The Table can be removed for fastening work to the Apron.

It has a strong, graduated swivel vise.

Quick work, rapid changes, modern ideas

Buy the best.

IMPROVED 15-INCH PILLAR SHAPER.

The Hendey Machine Co.,

Send for Circular. **TORRINGTON, CONN.**

EUROPEAN AGENTS:

Chas. Churchill & Co., Ltd., 21 Cross Street, Finsbury, London.
Schuchardt & Schutte, 59 Spandauer Strasse, Berlin.
Eugen Soller, Basel, Switzerland.

(Continued from page 38.)

erect a large steam flour mill and will equip with improved machinery.

The Edmonton Milling Co. have decided to build an elevator in connection with their mill at South Edmonton, N. W. T.

Gardner Bros., of Essex, Ont., Canada., intend to start a handle factory at Walkerville, Canada, to employ about 50 hands.

J. Loring & Co., Brighton, Mass., are intending to install new machinery for a large grain elevator which they are erecting.

A new concern, known as the Riverside Mfg. Co. has been organized at Connellsville, Pa. J. F. Hood, of Connellsville, is interested.

The New Castle and Mahonington Street Railway Co., New Castle, Pa., will erect an electric plant and place new machinery.

Schuylkill County Almshouse, Pottsville, Pa., will erect a large steam laundry, and install a line of new and improved machinery.

Ansley H. Fox, Baltimore, Md., is forming a company to manufacture guns, and will install a line of new and improved machinery.

A large foundry will be added to the works of the Casey & Hedges Co., of Chattanooga, Tenn. Foundry machinery will be installed.

Humphries & Rohan, manufacturers of brass mountings for harness, etc., of Canton, O., contemplate a branch factory in Canada.

It is reported that a large steel plant will be erected in New Castle, Pa., for the manufacture of hollow steel billets for bicycle tubing.

The Windsor, Mass., Print Works Company are to have a large addition built to the printing room and install new machinery for the same.

Phelps, Dodge & Co., New York, will erect an open hearth steel plant at New Castle, Pa., which will be equipped with a line of new machinery.

The Williamsport Wood Co., Williamsport, Pa., will shortly install a boiler, engine and woodworking machinery of the latest improved type.

The Inter-Urban Electric Street Railway Co., Saginaw, Mich., will erect large power houses midway between Saginaw and Bay City, Mich.

Corruna Furniture Mfg. Co., Corruna, Mich., will rebuild their extensive plant recently burned. Modern labor-saving machinery will be installed.

At Yarker, Ont., E. Benjamin is erecting a dry kiln, 45 x 45 feet, brick warehouse 36 x 75 feet, and a wheel and hub factory 45 x 72 feet, three stories high.

The Premier Steel Works of Indianapolis is making steel plates to be used by the American Tin Plate Works, of Elwood, Ind., in making tin plates.

On August 3d the factory of the Tourists Cycle Co., Syracuse, N. Y., was burned, the damage amounting to somewhere about $30,000. It is said they will rebuild at once.

The Berrein Springs Power Co., Berrein Springs Mich., has been incorporated to utilize the water power of St. Joe river by improved turbines and electric generating machinery.

At West Utica, N. Y., the Weston-Mott Co., of Jamesville, N.Y., will erect a plant which will give employment to about 50 hands, to engage in the manufacture of bicycle sundries.

The Rossland, B. C., Water and Light Company will increase their light capacity, and the Ratepayers' Association Fire Committee will memorialize the government for a grant in aid of the Fire Department.

The Manitou Wood and Pulp Co. and the town of Midland, Ont., Canada, are under agreement in which the company secures certain privileges and exemption from taxes to erect and operate a pulp mill at that town.

The Stearns Mfg. Co., Erie, Pa., are running their full force overtime, as are also the Hogan Mfg. Co. in their wire plant. The Erie Malleable Iron Works have also added a fine brick addition to their plant, about 60 x 100 feet.

The Union Carpet Lining Company, of Watertown, Mass., is making extensive improvements on its plant and will install new machinery. A new engine and boiler house is also to be built and new engine and boilers installed.

Charley Wells, Syracuse, N. Y., formerly with E. C. Stearns & Co., of that city, is interested in a wood frame bicycle patent, and a large brick building has been rented on South West street for the manufacture of said wheel.

J. B. Vosburgh, J. H. Springle, S. Woods, A. C. Cox, John Pyke and A. M. Foster, of Montreal, Canada, are applying for incorporation as the Associated Dental Company; capital $100,000; business, dental instruments and dental supplies.

The Morris Machine Works, of Baldwinsville, N. Y., have erected an extensive addition to their foundry to meet the increasing demand for pumping outfits for various purposes, such as circulating, dredging, wrecking, sewerage work, etc.

The Acme White Lead and Color Works, W. L. Davies, pres., and H. K. White, vice-pres., will build a permanent plant at Detroit, Milwaukee Junction. The building will be of brick, two stories high, 170 x 60 feet, and will cost $25,000.

The following corporations have filed articles of association with the Secretary of State at Lansing Mich.: Saginaw Bay Towing Co., $300,000; The World Cash Register Co., Kalamazoo, Mich., $100,000; Cheboygan Electric Light and Power Co., Cheboygan, $100,000.

W. H. Wortman, Thos. E. Pound, Albert E. Passmore, A. B. McKay and F. Stoneman are asking for a charter of incorporation to carry on a general foundry business under the title of the Wortman & Ward Manufacturing Co., with a capital of $100,000, and chief place of business London, Canada.

The Harlan & Hollingsworth Co., ship builders, of Wilmington, Del., announce that on July 1st their former president, Mr. J. Taylor Gause, retired from office after 54 years of active service in connection with the business. He is succeeded by Mr. Henry G. Morse, heretofore president of the Edge Moor Bridge Works, no other change being made in the official staff, personnel or policy of the concern.

The Ontario Gold Mines Co., Ltd., chief place of business, Windsor, Canada, capital $1,000,000, is the name of a new company seeking incorporation, to operate in the Province of Ontario, to crush, smelt, establish works, mills, factories, warehouses, etc. The applicants are R. A. Demme, Detroit; T. J. Hurley, Brooklyn, N. Y.; Chas. N. King, Jersey City, N. J.; Henry Weston, F. J. Corning and Henry Clay Berlin, New York, and Arthur St. George Ellis, Windsor, Ont.

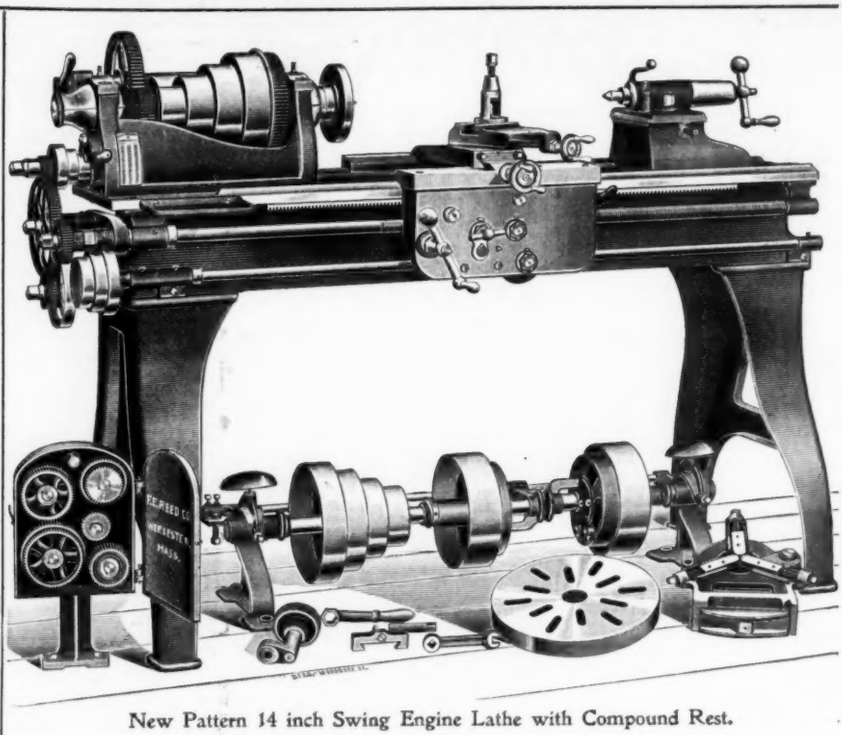
The following mining companies are being incorporated in British Columbia: At Rossland—The Red Mountain View Gold Mining Co., capital $1,000,000; the San Francisco Gold Mining Co., $1,000,000; Pittsburg Gold Mining Co., $750,000; The Erie Gold Mining Co., $1,000,000; Kootenay-London Mining Co., $1,000,000; The Columbia Mining Co., Victoria, $100,000; The Victoria Mining and Development Co., Victoria, $1,000,000; The Queen Gold and Silver Mining Co., Vancouver, $500,000; The Alliance Prospecting Syndicate, Vancouver, $100,000; The Alberin Mountain Rose Gold Mining Co., Vancouver, $250,000.

▲ ▲ ▲

New Catalogs.

There are three sizes of Standard Catalogs, first authorized by the Master Car Builders' Association, 9" x 12", 6" x 9" and 3½" x 6". We recommend the 6" x 9" size for machinery catalogs. When they must be larger or smaller, one of the other standard sizes should be adopted if possible.

Timmis & Clissold, Bound Brook, N. J., issue a catalog of pattern shop supplies and machinery which include dowel plates and pins, rapping plates and keys, pattern letters, vises and such machines as are used in pattern shops. It is 3¼ x 6¼ inches.



New Pattern 14 inch Swing Engine Lathe with Compound Rest.

▲ ▲ ▲

New Illustrated Catalogue Sent on Application.

F. E. REED COMPANY,

Gold Street, WORCESTER, MASS.

MANNING, MAXWELL & MOORE, Selling Agents, New York, Pittsburgh, Chicago.

The Pratt & Whitney Co. HARTFORD, CONN., U.S.A.

... MAKERS OF ...

Fine Machine Tools.

Complete Plants furnished for Bicycle, Typewriter, Gun and Sewing Machine Makers. Gauges and Small Tools for all Machine Work. Drop Hammers and Trimming Presses. Forging and Trimming Dies for all classes of work.

ENGLAND—BUCK & HICKMAN, 280 Whitechapel road, London, E.; CHAS. CHURCHILL & CO., LTD., 21 Cross st., Finsbury, London, E. C.
FRANCE—F. G. KREUTZBERGER; FENWICK FRERES & CO., 21 Rue Martel, Paris.
CHICAGO—42 and 44 S. Clinton st. BOSTON—281 Franklin st. NEW YORK—123 Liberty st.

THE GAS AND OIL ENGINE. By DUGALD CLERK.

SIXTH EDITION, REVISED AND ENLARGED.

568 Pages.
228 Figures.
Crown 8vo, $4.00.

JOHN WILEY & SONS,
53 East Tenth Street, NEW YORK.

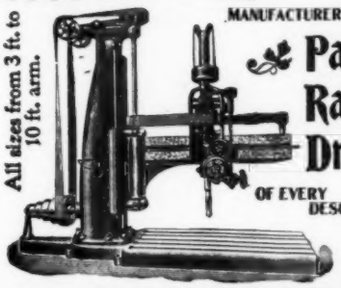
LIGHTNING CLUTCH DIE HOLDER

For use in turrets of screw machines, screw plates, taps, dies, reamers, tap wrenches, bolt cutters, drilling machines, etc. SEND FOR CATALOGUE.

WILEY & RUSSELL MFG. CO.,
GREENFIELD, MASS., U. S. A.

BAUSH & HARRIS MACHINE TOOL CO. HOLYOKE, MASS.

MANUFACTURERS OF



All sizes from 3 ft. to 10 ft. arm.

Patent Radial Drills

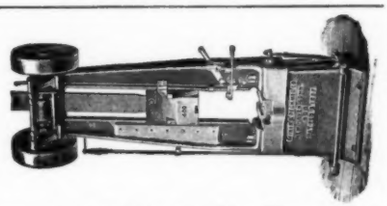
OF EVERY DESCRIPTION.

CUTTING OFF

MACHINES, the Latest and Best.

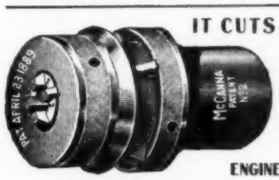
HURLBUT ROGERS MACHINE CO.,

SO. SUDBURY, MASS.



Miner & Peck Mfg. Co., New Haven, Conn.

IT CUTS COSTS.



The McCanna Adj. Thread Cutting and Milling Tool.

Made only by

THE TAYLOR-RICE ENGINEERING COMPANY,

Works: Gloucester City, N. J., U. S. A.

THE WATERBURY

FARREL FOUNDRY AND MACHINE CO.

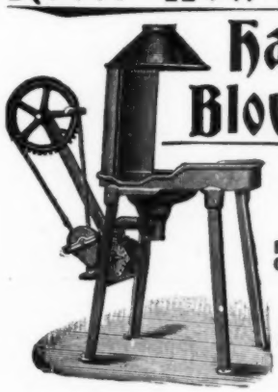
Waterbury, Conn., U. S. A.

BUILDERS OF MACHINERY FOR MAKING

HARDWARE

STEEL TUBE, BICYCLE PARTS, BRASS GOODS, SILVERWARE AND STEEL GOODS.

Roots' New Acme Hand Blowers



SLOW SPEEDED. FORCE BLAST. DURABLE. COMPACT. CHEAP.

P.H. & F.M. ROOTS, Connersville, Ind.

BOX 376B.

NEW YORK, 109 Liberty St.

J. B. STEWART, MANAGER.

BUFFALO VENTILATING FANS

ELECTRIC, STEAM AND PULLEY TYPES. GREATEST AIR VOLUME. LEAST POWER

BUFFALO FORGE CO. BUFFALO, N.Y. U.S.A.

Chicago, 22 and 24 West Randolph Street.

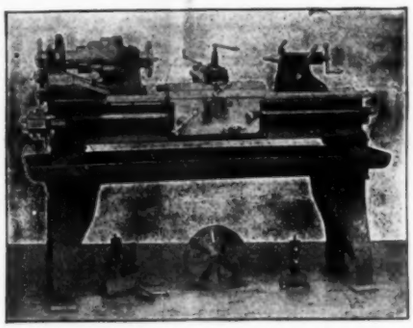
New York, 26 Cortlandt Street.

PROGRESSIVE AND APARTMENT TYPES

BUFFALO LUMBER DRY KILNS.

BUFFALO FORGE CO. BUFFALO, N.Y. U.S.A.

The Lodge & Shipley Machine Tool Co.



CINCINNATI, OHIO.

Makers of Engine Lathes,

from 14" to 42"

The entire index for Feeding and Screw Cutting is obtained instantly without removing a single gear from its shaft.

The range of feeds and threads is extensive; in the 14" from 8 to 128 if desired.

Change gears are mounted on shaft running in bearings at both ends. All feeds are indexed.

ASBESTOS CEMENT FELTING,

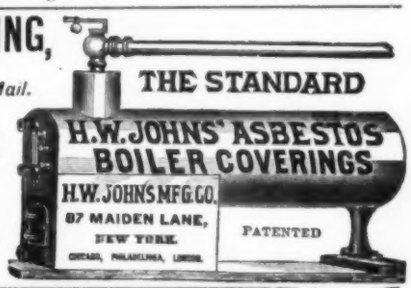
FOR LAGGING LOCOMOTIVE BOILERS.

Samples and Descriptive Price List Free by Mail.

We are prepared to take Contracts for applying Steam Pipe and Boiler Coverings in any part of the United States.

H. W. JOHNS MANUFACTURING CO.

87 Maiden Lane, NEW YORK.



Cincinnati Universal Grinders

Will not only grind Cutters and Reamers rapidly and correctly, but are also arranged for circular and surface grinding. Most Complete and yet simple. Write for pamphlet.

THE CINCINNATI MILLING MACHINE CO.

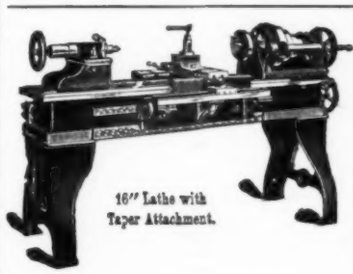
Station B. • • • CINCINNATI, O.

CRANES, TROLLEYS, PORTABLE HOISTS; OVERHEAD TRACK.

SEND FOR CATALOGUE.

MARIS BROS.,

2343 & 2345 Callowhill St., PHILADELPHIA, PA.



16" Lathe with Taper Attachment.

The Flather New Patent Taper Attachment.

Accurate.
Easy and quick to operate.
No backlash or lost motion.
All changes can be made from front of lathe.

THE BEST.

FLATHER & COMPANY, - NASHUA, N. H.

This machine has a hole $1\frac{1}{16}$" in diameter through spindle and turns any length to 4".

BROWN & SHARPE MFG. CO.

PROVIDENCE, R. I.

No. 2—13-16 in. x 4 in.

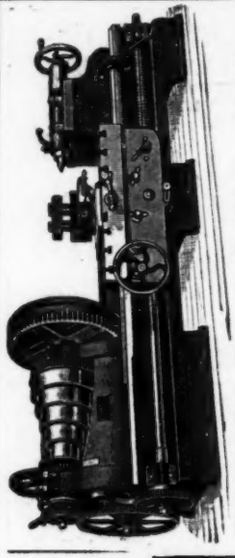
Screw Machine.

WITH AUTOMATIC CHUCK AND WIRE FEED.

Patented April 1, 1890; April 2, 1895; July 30, 1895.

THE chuck is so constructed that ordinary variations in size of the stock make no difference in accurate feeding, and no stop is usually required. The feed is uniform, and the holding capacity of the chuck may be made as strong as desired without extra labor for the operation.

The action of the chuck and feeding mechanism is rapid. The rod of stock is fed forward, and the chuck closed by pressing and instantly releasing the small lever on the front of the headstock of the machine.



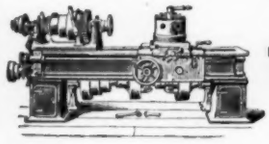
FIFIELD TOOL CO.,

MANUFACTURERS OF

ENGINE LATHES

from 17 to 64 in. swing. Cuts, Photographs and Prices furnished on application.

LOWELL, MASS., U. S. A.



WARNER & SWASEY,

CLEVELAND, OHIO.

MANUFACTURERS OF

TURRET ENGINE LATHES,

IRON AND BRASS WORKING MACHINERY.

SEND FOR ILLUSTRATED CATALOGUE.

THE HARRINGTON & KING PERFORATING CO

PERFORATED METALS OF EVERY DESCRIPTION FOR ALL PURPOSES

CHICAGO 227 N. UNION ST.

EASTERN OFFICE NO. 204 PEARL ST. NEW YORK

We have a few of our common lathes in stock, new, as follows; will sell at a low price, guaranteeing them strictly first-class:

One	16 inches	by	12	feet with taper attachment.
One	18	"	10	"
Two	21	"	10	"
One	24	"	12	"
One	24	"	14	"

THE HENDEY MACHINE CO., TORRINGTON, CONN.

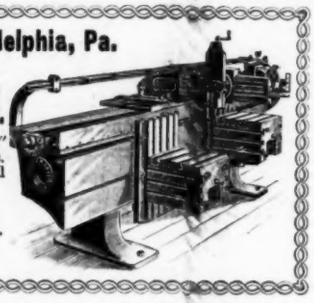
Wanted—An Idea

Who can think of some simple thing to patent? Protect your ideas; they may bring you wealth. Write JOHN WEDDERBURN & CO., Patent Attorneys, Washington, D. C., for their $1,800 prize offer and list of two hundred inventions wanted.

PEDRICK & AYER CO., Philadelphia, Pa.

MANUFACTURERS OF

Richards Open Side Planers.



Made in sizes from small shapers to 12"×42" regular, or made special to suit requirements. Their merits endorsed by over 100 users. Special catalogue of applications.

MANNING, MAXWELL & MOORE,

Sole Sales Agents. 111 & 113 Liberty St., New York.

424 TELEPHONE BUILDING, PITTSBURGH, PA. | 60 SOUTH CANAL STREET, CHICAGO, ILL.

Fine Grade Drop Forgings.

WYMAN & GORDON,

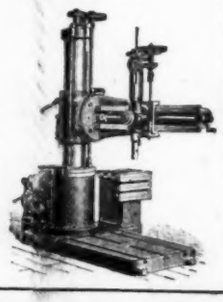
WORCESTER, MASS.

UPRIGHT DRILLS.

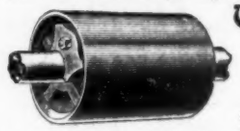
IF YOU WANT PRICES ON THEM, OR ON OUR RADIAL AND UNIVERSAL RADIAL DRILLS OR BORING MILLS, TELL US QUICK.

BICKFORD DRILL AND TOOL CO.

3 Pike Street, CINCINNATI, O.



Stuart's Patent Compression Wedge Coupling.



REQUIRING NO KEYS.

Have successfully stood the test for 8 years and are still being shipped **on trial, or money returned** if you want it. All sizes kept in stock.

R. J. STUART'S FOUNDRY AND MACHINE WORKS,

NEW HAMBURGH, N. Y.

JONES & LAMSON MACHINE COMPANY, SPRINGFIELD, VT.

SEE PAGE 16.

FLAT TURRET LATHE.